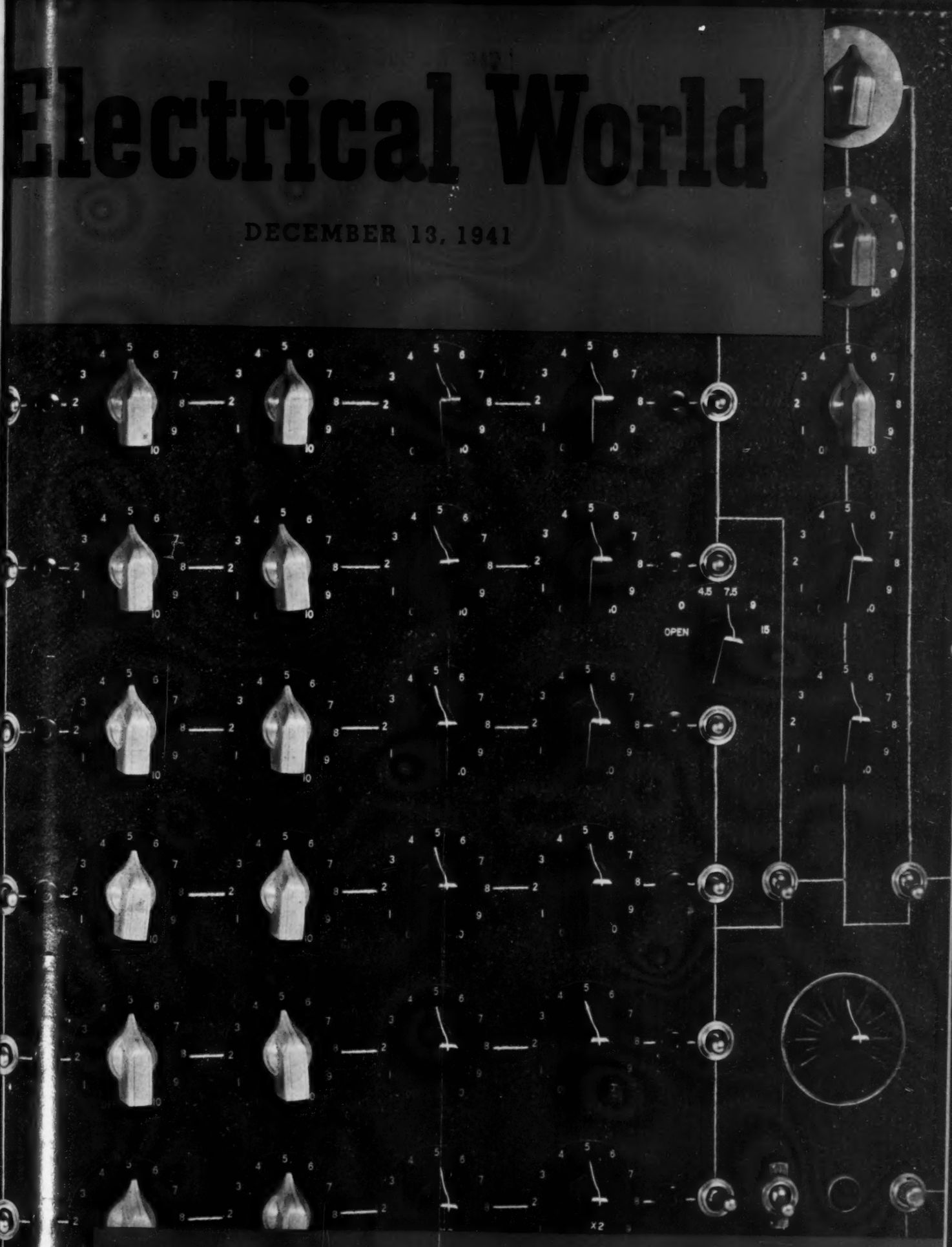
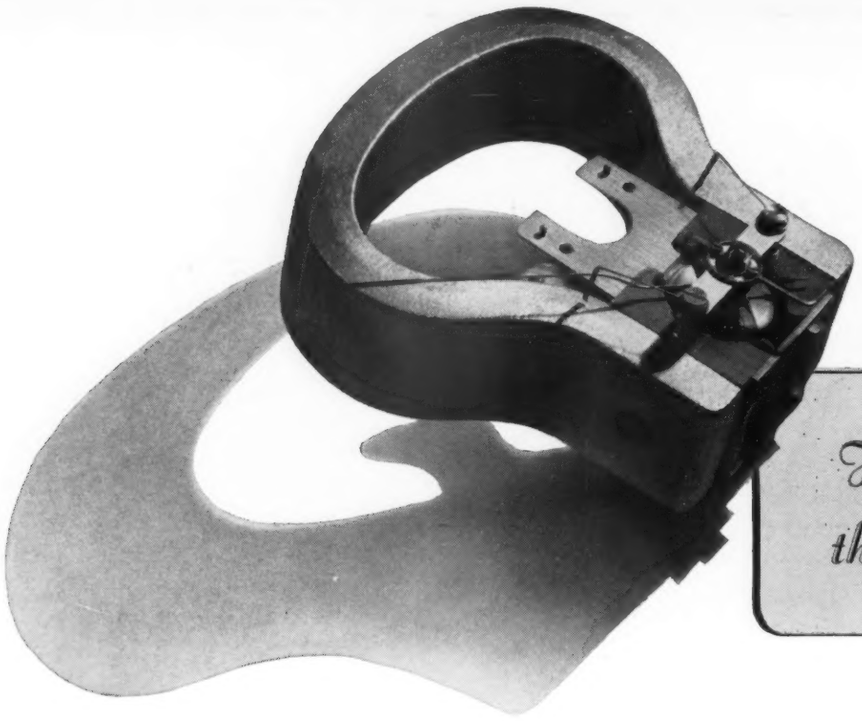
Electrical World

DECEMBER 13, 1941



ANALYZER FOR CURRENT TRANSFORMER SATURATIONS



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December 13, 1941

Contents

Vol. 116, No. 24

Determine Transformer Load from Customer Records..... 72
JOHN WALLIS and PERRY SHELLEY, *Oklahoma Gas & Electric Company*

Mercury Cycle Given Go-Sign at Power Session..... 75
A. E. KNOWLTON, *Associate Editor*

Wired Radio Controls Street Light Circuits..... 77
FLOID M. FULLER, *Pennsylvania Power & Light Company*

Oswego Station Design Pioneers New Ideas..... 78

Transformer Protection Timed for Secondary Faults..... 82
BRUCE O. WATKINS, *Rural Electrification Administration*

Transient Analyzer Checks Breakers and Bus Protection..... 85
J. H. NEHER and R. J. WOODROW, *Philadelphia Electric Company*

Range-Water Heater Combination Reduces Distribution Demand..... 87
W. S. FLEMING, *Nevada-California Electric Corporation*

Suspended Buses Carry Heavy Current..... 89
L. N. GREER and L. T. GUESS, *Aluminum Company of America*

Do They Read It?..... 90
C. J. ALLEN, *Connecticut Light & Power Company*

Washington Comment..... 94

News of the Week..... 95

Editorials.....71 and 92
Field Operating Practices..... 104
Industrial Engineering..... 110
Load Building..... 114
New Engineering Ideas..... 120
New Equipment..... 124
Manufacturing and Markets..... 129
News About People..... 136
Sales Opportunities..... 152
Recent Rate Changes..... 154
Rural Allotments..... 155
Letters to the Editor..... 158

Index of Advertisements..... 160

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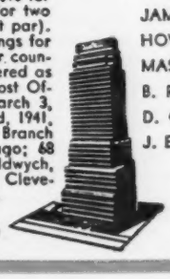

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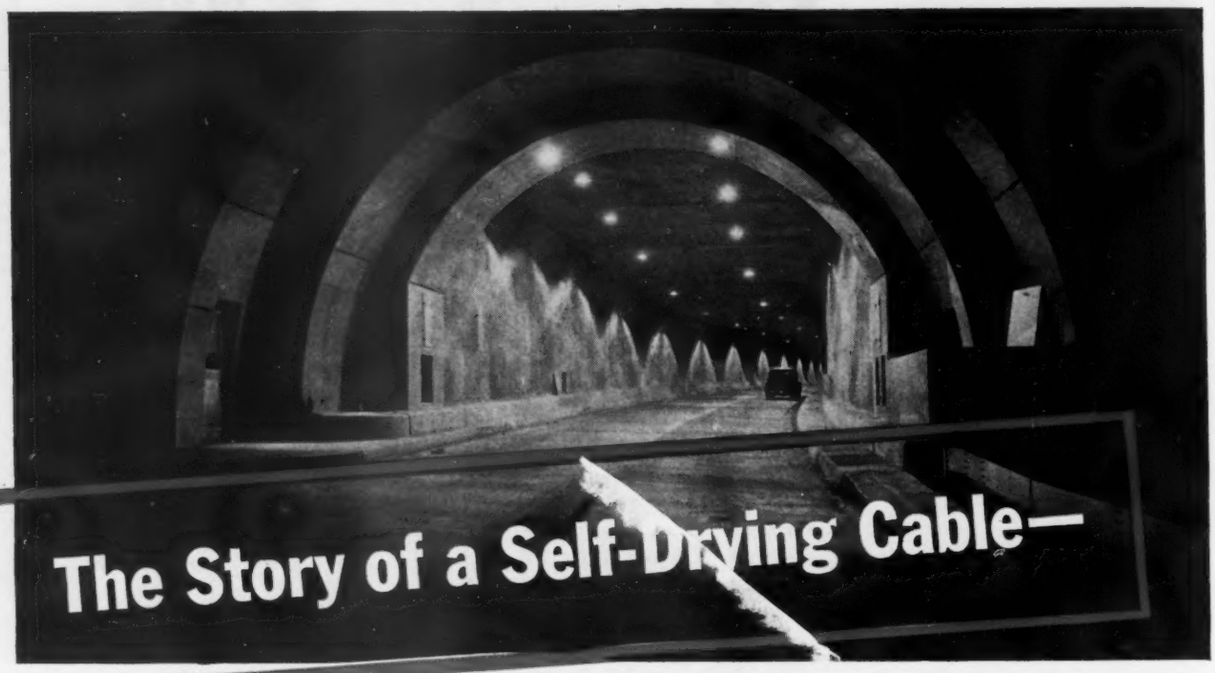

The Story of a Self-Drying Cable—

HOW OKONITE ENGINEERS HELPED TO PROVIDE UNFAILING LIGHT FOR THE WORLD'S MOST MODERN HIGHWAY

THE PROBLEM

Mercury vapor lamp unit with Okoglass cable lead

Pennsylvania Turnpike Engineers required a cable for mercury vapor lamp leads capable of withstanding the extremely high heat encountered and also capable of supplying unfailing service even after possible exposure to corrosive mine waters (a condition likely to be encountered in event of a prolonged outage). The conductors had to be highly corrosion-resistant as well.

The problem was further complicated by the fact that the assembled lighting unit must be periodically removed for cleaning. This necessitated a cable that could withstand repeated flexing. This combination of requirements ruled out the possibility of using any organic insulation and made a pioneering approach essential.

THE SOLUTION—Okonite engineers were consulted and their pioneer development work done years ago on fiber glass proved to be invaluable. This original research had led to revolutionary designs in heat-resisting cables and brought great improvements to windings for high-temperature electric motors.

Application of the findings of this work to the new problem resulted in a cable construction which consisted of fiber glass insulation and glass braids over an Okoloy-protected copper conductor with aluminum basketweave outer covering. The aluminum sheath was used as the return path for the lamp circuit.

Okoglass-insulated "self-drying" cable

THE PROOF

Test (1) 24" length of cable supported in air at temperatures between 212° and 250°. Tap water dripped on the cable at rate of one drop every 20 seconds. No observable effect on operation; ammeter at lamp showed a reduction in current through the lamp of less than 4/5 of 1%.

Test (2) 24" length of cable immersed in tap water for 23 hours was connected to operate an AH-5 mercury lamp. When power was applied, the cable began to heat up and steam appeared surrounding it. After 2 minutes, the light flashed on and went out. This cycle repeated with longer "on" periods until, after the fourth flash, the light stayed on. Self drying was complete; the cable cooled down to room temperature and appeared perfectly dry.

". . . the proposed cable . . . is fundamentally correct".
—Arthur J. Sweet

THE CONCLUSION—In the words of Arthur J. Sweet, noted lighting expert, who was consultant for the Turnpike authorities and who suggested the basic design of the cable . . . "I regard the tests as establishing that the proposed cable construction is fundamentally correct for the projected service . . . On behalf of my client, I wish to express the most cordial appreciation of your courtesy in making up to our tentative specifications, a 50-foot sample . . . and in affording us the facilities of your laboratory and the invaluable assistance of your men in testing this cable."

AN INVITATION—You, too, may need a cable to overcome some difficult operating condition. Why not ask Our Engineering Service Department to work with you in finding the right solution?

THE OKONITE COMPANY
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Steady

Monday of this week saw a deluge of conferences in business offices and between business men feverishly striving to determine the effect of the sudden attack by Japan on this country and the declaration of war. What should they do? What should they not do? Unless people remain calm and rely on sober judgment, a serious harm can be done. This is no time for hasty decision.

In many ways the situation that confronted us on Sunday was no different from that of the death of a person afflicted with an incurable disease, whose taking off was known for some months to be but a matter of time, and that short. Of course, when the end came it was a shock because of its finality. But after a short while it was realized that life must go on and work must be done.

And so it is now. The Army and the Navy will take over the prosecution of this war. If there are changes to be made in our mode of living or working they will tell us. Until then our job is to keep on living and working. In fact, plans hastily made to stop doing this or that may have the effect of being injurious to our war effort.

Back of our fighting men must be a fighting public—a public with a fine morale. In a measure this morale is a responsibility of business men, because what they do is quickly reflected in what their employees do. Let us do nothing that would have the effect of making people any more jittery.

When this war broke out in Europe we used to marvel at what appeared to be the nonchalance of the British in their attitude "that business must go on as usual, regardless." We now know that it was poise—equilibrium—and that from it came the confidence that could not be swayed by bombings, reverses or sufferings. Morale like that means victory in the end.

There is one change, of course, that this war will bring and quickly, and that is the reuniting of the people of this country behind the government. It is the signal to labor to bring to a close its own war for organization position that it might throw its whole weight behind our armed forces. It is the occasion for full cooperation between business and government without strife over political and social economic objectives.

There is no room today for any warfare but that against the enemy. There is no brief today for public as against private construction—only for that which is necessary and can be done the quickest and with the least amount of critical material. Government must be trusted in a time like this to think only of that which will bring victory over the enemy.

There is no question but what individuals and business will be called upon to make sacrifices—greater than anything probably we have known. This we will do willingly because it is our country that has been attacked.

We have seen this war coming for some time and our government has not been asleep in making its preparations. Let it not frighten us or stampede us into doing things that hurt the public morale rather than help it. Let us make our sacrifices as called on to do so by our trained experts who are running the show, and in the meantime let us take a leaf out of the experience of England and not be stampeded—let us be steady.

Determine Transformer Load From Customer Records

Based on empirical relationship between energy sales through transformer and diversified maximum demand per customer, new statistical method determines transformer peak loading accurately and at low cost

JOHN WALLIS and PERRY SHELLEY, Oklahoma Gas & Electric Company

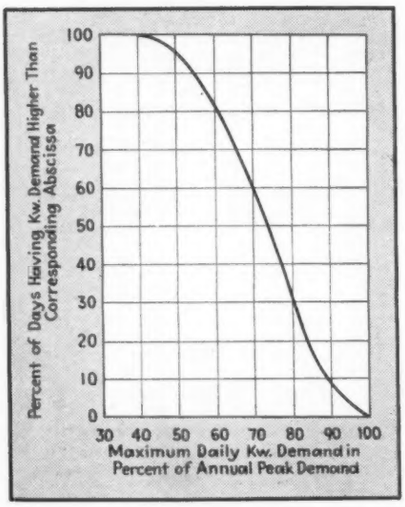


FIG. 1—Frequency curve of daily kw. demand reveals inaccuracy of transformer peak load estimating methods based on short-time instrument checks. One chance in eleven that demand measured will reach 90 percent of peak

BECAUSE a large part of any system investment is in distribution transformers, considerable importance attaches to economies that can be obtained by careful supervision of transformer loads. There are reasons to believe that there is no method of measuring by short-time test or of estimating transformer loads that is 100 percent accurate. The only way to determine positively what the maximum demand on a transformer may be is to install a demand meter permanently. This procedure is obviously impractical. The accuracy of specific short-time tests is not questioned, the loads so determined do prevail at the time of the test, but their relation to peak loads is not known. The chance of making a short-time test on a specific transformer during its peak load is relatively small, so in all cases the test results must be interpreted.

A new statistical method for estimating the peak loading of distribution transformers in residential areas has been developed by the Oklahoma Gas & Electric Company, which is believed to be more accurate and less costly than accepted test methods of load determination.

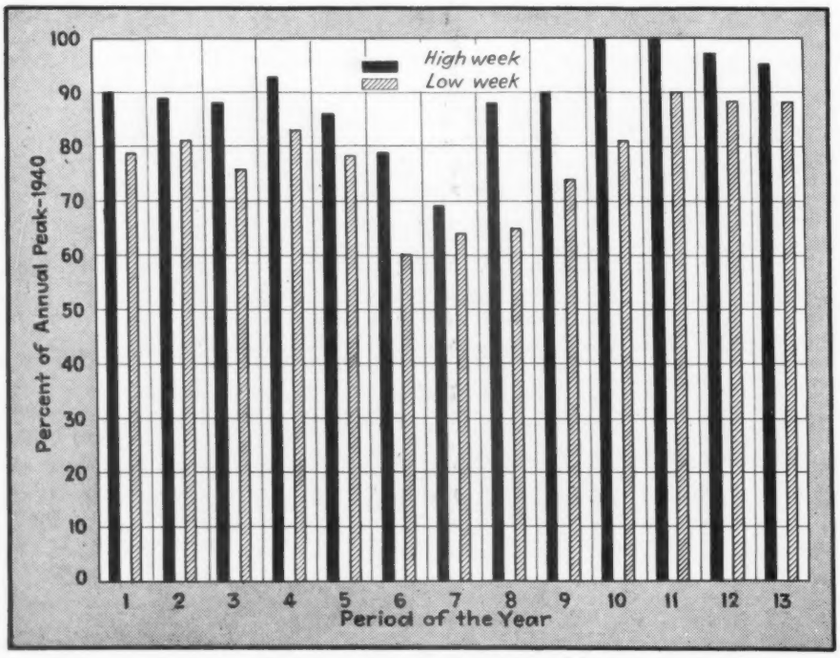


FIG. 2—Weekly variation in maximum kw. demand for a residential area shows little consistency between weekly high and weekly low. Sure only of catching 60 percent of peak

New Empirical Approach

The basis of this estimating method is a consistent empirical relationship between average annual kilowatt-hour sales per customer through a given transformer and the diversified maximum demand per customer connected to that transformer, revealed by extensive studies in eleven test areas in nine separate cities. With average annual kilowatt-hour sales per customer for any transformer known, the resulting diversified maximum demand per customer in kva. given by this relationship is corrected by applying a customer diversity factor.

The average customer's corrected maximum demand, so obtained, is then multiplied by the number of customers connected to the transformer to give the peak transformer demand.

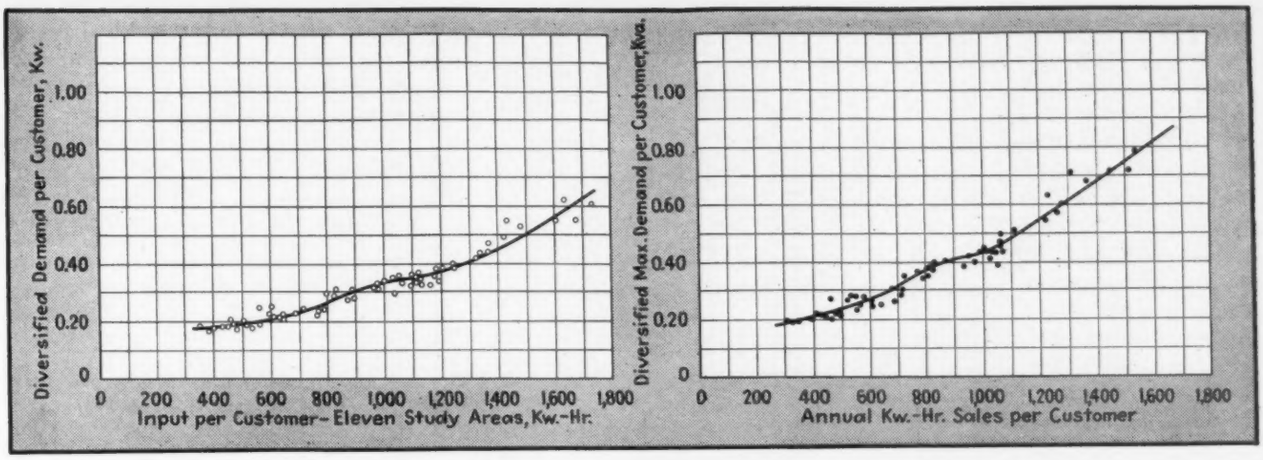


FIG. 3—Uncorrected curve showing relationship between transformer input and diversified maximum demand per customer (left). FIG. 4—Corrected to a base of 75 customers and 90 percent power factor, this empirical curve forms the basis of the O. G. & E. transformer load check method (right)

Experience with this method for transformer load determination on the O. G. & E. system, though limited, has yielded very satisfactory results. Advantages that have appeared are as follows:

1. Superior accuracy—both from a theoretical consideration and from comparison of tests, results seem to be more accurate than those obtained by any other method.

2. No special equipment is required for making load determinations. Both the first cost of testing equipment and the cost of maintenance and repair are avoided.

3. Testing of transformers is not confined to a particular season of the year.

4. Speed with which transformers can be tested is not limited by the available testing equipment and it has been possible to determine transformer loading at a much faster rate than was possible heretofore. This permits coordination of test schedules with engineering.

5. For special study purposes it is possible to determine loads that existed during past years.

Eleven Test Areas

In arriving at group load characteristics the O. G. & E. Company selected eleven residential test areas in the winter of 1932. The areas were in nine separate cities of varying population well distributed over the state. The number of customers in the smallest area was about 50 and in the largest about 600. Other areas are fairly well proportioned between these limits. Each area was served by a section of primary circuit in which meters were set to measure kilowatt-hour input and kilowatt demand. In these areas fifteen-minute integrated demands were recorded on seven-day charts. Charts were changed and the kilowatt-hour input meters read each week. Sales to all the customers in each area were taken from meter readers' books so that data are available either direct or by computation showing:

Demand by fifteen-minute intervals.
Kilowatt-hour input by weeks and years.
Kilowatt-hour sales by months and years.
Kilowatt-hour losses by months and years.

Although they were taken for another purpose, the data that have been accumulated from the test areas afford the basis for mistrusting the accuracy of short-time tests and for developing the O. G. & E. method of transformer load determination.

A frequency curve of daily maximum kilowatt demand for one study area during 1940 is shown (Fig. 1). This curve shows that by using ampere demand meters for 24-hour tests one is only sure that 40 percent of the peak is measured. An even chance exists that 74 percent of peak will be measured; there is one chance in three that the measured load will be 80 percent of peak, and one in eleven that it will be 90 percent of peak.

The maximum demand on each seven-day chart was read and recorded. The highest and lowest recorded values for each four-week period of a thirteen-period calendar were expressed as a percent of annual peak. The resulting chart (Fig. 2) shows that when one installs ampere demand meters and leaves them

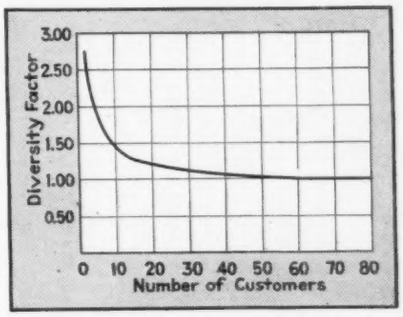


FIG. 5—Diversity between residential load demand groups on a 75 customer base

for a week on a given transformer he is only sure of measuring 60 percent of the peak. In some four-week periods the maximum demand in one week may be 40 percent more than in another week. There is no consistent relation between high and low values of weekly demand for any period, nor is there any seasonal correction factor which can be applied with accuracy.

A method of maximum demand determination with improved accuracy is necessary if close supervision of transformer loading is to be exercised.

Data Translated

The test area data afford a basis for a new method by which annual kilowatt-hour consumption can be translated into transformer load. An orderly relationship between annual consumption and diversified demand is evident from the curve (Fig. 3) which covers 20,426 customer years. The inherent accuracy and consistency in the relationship is shown by the fact that all of the points lie close to the curve. A little eccentricity is

apparent, which may be traced to an increase in refrigeration and appliance saturation. However, this curve cannot be used to determine transformer load because the kilowatt-hour values include losses, because kilowatt-hours input to a transformer are not readily obtainable and, further, because the various points represent different numbers of customers from 50 to 600 and therefore have different weights.

In Fig. 4, the curves from which the O. G. & E. method was derived, each point has been corrected for 75 customers (that being more than are likely to be connected to any single transformer). Values on the abscissa are plotted in kilowatt-hour sales which are obtainable from meter readers' books. The same orderly and consistent relationship between kilowatt-hour sales and diversified demand per customer obtains for this curve. The points are both above and below the curve, but only one or two depart as much as 10 percent.

There being fewer than 75 customers on most transformers, the demand per customer in the smaller groups will be greater than shown in Fig. 4.

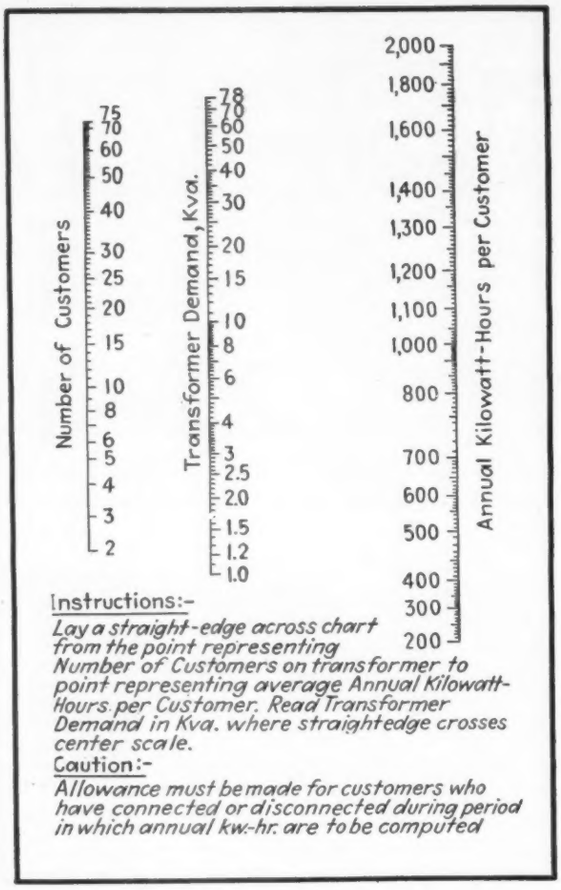


FIG. 6—Nomogram for simplifying calculation of transformer demands in residential areas

Fig. 5 is a diversity curve from which factors can be read for groups smaller than 75. These factors, when multiplied by the demands in Fig. 4, will give the diversified demand per customer for smaller groups.

Thus, residential transformer loads are determined by the O. G. & E. method, as follows:

1. Determine the total annual kilowatt-hour sales through a transformer from the meter readers' books.
2. Divide the sales by the number of customers to find average kilowatt-hour sales per customer.
3. Enter the curve in Fig. 4 with the above kilowatt-hour value and read per customer demand.
4. Multiply the per customer demand by proper diversity factor taken from Fig. 5 to get corrected diversified demand per customer.
5. Multiply the corrected demand per customer by the number of customers.

The foregoing routine has been set up on an alignment chart (Fig. 6). With it the above steps are quickly accomplished, as follows:

1. Determine the total annual kilowatt-hour sales through a transformer from meter readers' books.
2. By one slide rule operation determine the average sales per customer.
3. From Fig. 6 find the transformer load on the middle scale by drawing a line from the number of customers to the kilowatt-hour consumption per customer.

Maximum Month Ignored

The question may arise as to why the single month of maximum kilowatt-hour consumption is not used for determining loads. Fig. 7 shows kilowatt-hour and maximum demand for each of the thirteen periods of the year 1940 for one area. This illustrates that the greatest kilowatt-hour use and the highest kilowatt demand do not occur in the same period. Therefore, no relation exists between these two values for loads such as prevail in residential areas on the O. G. & E. system. Examination of data for other years and test areas confirms this conclusion.

So far the O. G. & E. method can be applied only to transformers serving residential loads. Cumulated test-area data for several commercial districts show a consistency which indicates that the method can possibly be extended to cover this latter group also.

When the new method was first tried it was used to determine the load on a number of transformers that had already been tested by the ampere demand meter method, in order to compare the results given by these two methods. The accompanying table shows the comparison for several of the transformers tested.

[*Continued on page 149*]

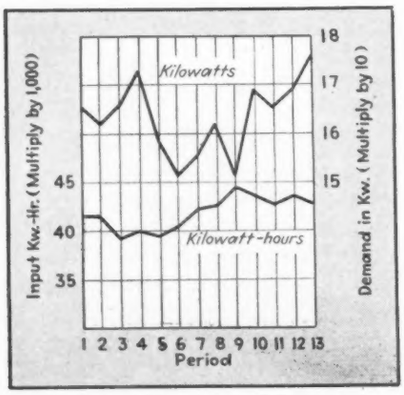


FIG. 7—Peak demand and peak consumption do not necessarily occur simultaneously

Comparison of Transformer Load Test Methods

Transformer Size, Kva.	No. of Customers	Annual Average Kw.-Hr. per Customer	—Maximum Kva. Load— O.G. & E. Method (1)	Amp. Demand Meter Method (2)	% Ratio (2) (1)
5	20	875	6.3	6.2	98.5
5	17	990	8.8	7.6	86.4
7.5	50	469	12.0	13.0	108.3
7.5	26	949	12.2	8.2	67.2
7.5	21	835	9.4	7.7	81.9
10	28	833	12.0	5.0	41.7
10	39	828	16.0	10.3	64.4
10	20	1177	12.5	14.0	112.0
10	15	1338	12.4	10.7	86.3
10	39	920	17.5	11.5	65.7
10	29	1210	17.5	17.6	100.5
15	36	1054	17.5	14.2	81.4
15	23	1178	14.0	10.3	73.5
25	53	1186	29.2	29.8	102.0
25	36	1450	28.1	18.7	66.5

Mercury Cycle Given Go-Sign at Power Session

Large A.S.M.E. gathering told mercury-vapor power generation is now "of age" — Super-superposition seen as field — Emmet eulogized — Oswego plant is called progressive, sound, conservative

Reported by A. E. KNOWLTON, Associate Editor

MERCURY as a thermal medium for power generation was given a technological release by both the equipment manufacturer and the users of the cycle at a significant power session of the convention of the American Society of Mechanical Engineers in New York, December 1 to 4, 1941. After 28 years of persistence the development was called "of age"—"maintenance no more difficult than steam"—"operating personnel have confidence in the system" — "the boiler can take it"—"application now expected to proceed with increasing rapidity."

Kearny Performance

Eighteen months performance of the Kearny 20,000-kw. mercury unit,* said A. R. Smith (General Electric), has demonstrated the practical solution of the chemical problems arising from contact of mercury with iron at high temperature. Introduction of minute quantities of magnesium and titanium insures the desired surface wetting and prevents the solution of iron in mercury which was at the root of obstinate tube deposits. Steady reduction in volume of mercury with extension of the heating surface has and will further greatly improve the circulation ratio of liquid and vapor. The Velox type of boiler, he suggested, offers wider advantages for mercury than for steam.

Future applications may attain better than 50 percent thermal efficiency, asserted H. N. Hackett (General Electric), citing the attainment already at Kearny of a net kilowatt-hour for 0.5 lb. of fuel oil. At 500 psi., 1,500 deg. F. the fuel consumption should be down to 0.41 lb.

From May 6, 1940, to October 27, 1941, the Kearny unit operated 83.6 percent of the elapsed time, average load 19,700 kw., capacity factor 82.3 percent, said P. S. Hartung (Public Service Electric & Gas). In the latter seven months it carried 21,000 kw. with only two interruptions. Coal firing was impracticable until soot blowing was installed in March, 1941. Present revamping is expected to correct the residual instability with pulverized coal firing. Air infiltration, once as high as 500 cu.ft. per hour, has been reduced to 0.2 cu.ft. per hour. Vigilance is still necessary, temperature has to be known for at least one tube in ten, but the operating personnel has great confidence in the unit and maintenance does not appear to be any more difficult than for steam equipment. Full load can be reached in sixteen hours from lighting off, the last seven hours for raising load by 2,000-kw. steps per hour, he added.

Boiler Safe and Conservative

Steam experience has helped mercury progress and vice versa, stated Perry Cassidy of Babcock & Wilcox. Boilers generally have kept pace with turbine development and both are almost invariably ahead of the possibilities afforded by metallurgy. The Kearny boiler was designed to be safe and conservative and cost was a secondary consideration during the evolution. He lauded the painstaking chemical research by General Electric and was confident that the system may now proceed with increasing rapidity.

Treatment of the mercury in the new Marcus Hook refinery boiler with magnesium and titanium has completely inhibited the solution of iron, said H. E. Melton (Sun Oil). The solids are trapped in and removed from a low-velocity flooded line. With the former boiler a hydrochloric acid pickling had been necessary every 1½ to two years. Thorough surface wetting now prevents the oxidations.

Superposition

There is going to be opportunity to go the rounds of utility plants ultimately to superpose the mercury cycle over some of the present steam superpositions, stated Glenn B. Warren (General Electric), foreseeing gains as great as those that came from moving from 200 to 1,200 psi. with steam. He, also, said mercury "had come of age."

Tribute to the perseverance and personality of William LeRoy Emmet, veritably the "father of mercury," was paid by R. C. Muir, General Electric vice-president. After working on the Curtis turbine at 40, electric ship propulsion at 50, he swung to the mercury boiler-turbine at 60 and clung tenaciously to it, up to his death this year—the year of maturity for the process. Later Muir said there was confidence that metallurgists would supply the metals for still higher temperatures and that he expected the mercury cycle now to assume an increasingly important place in the power field. E. S. Thompson (G.E.) said supercharger developments support this prospect.

*See also "Mercury Vapor Extends Life of Steam Sites." "Electrical World," March 22, 1941, page 56.

Oswego Station a "Monument"

"Most progressive yet safe and conservative station yet noted" was the characterization of Oswego station by Ralph C. Roe of Burns & Roe, consultants in the design. "Too modest" was the characterization of the authors (N. R. Gibson and H. M. Cushing) of the A.S.M.E. paper on the station by J. R. Baker of Pennsylvania Water & Power Company. He decried their confinement to details and said they could well have pointed to the fact that it has the smallest consistent number of largest justifiable turbines to operate at the highest practicable steam pressure from the largest warrantable boilers. Also, the design approaches the peak of thermal performance at most advantageous unit cost. These attributes, he felt, overshadow the innovations (air for soot blowing, separate panels for each pulverizer, etc.) enumerated in the article elsewhere in this issue of ELECTRICAL WORLD.

The boiler and coal-preparing and combustion equipment have never, in a year's operation, shut down the plant or asked for reduction in duty, said Alfred Iddles of Babcock & Wilcox. Water treatment has been so good that there has been no scale, no corrosion, and infinitesimal sludge. Nor has any work on the outside of the heating surfaces been necessary except to tighten a loosened damper. The steam generator has demonstrated its ability to carry full load and to respond to sharp swings of load; from 700,000 to 900,000 lb. per hour has been carried all summer.

Further comment sent in by Roe stated that the hydraulic circuits in the boilers had set the pattern for ensuing designs, that it was easy to clear the tube banks of slag accumulations, that air soot blowing saves B.t.u. by cleaning without corrosion and that the electrodynamic fan couplings and largest-yet direct-contact heaters called for courage to adopt them at such critical points.

Other pioneering points cited by H. M. Cushing were the record size (80,000 kw.) of the single-shell, single-shaft turbine for condensing operation at 1,250 psi., the enhanced speed of response of the Roe control to meet the 25 to 1 range of station loading. This spread justified, he said, the fan control because it afforded instantaneous response, unlimited number of steps and a linear speed-pressure relation. Also, the 200-ft. stacks are the largest all-(butt)-welded.

There have now been 3,000,000 kw. of 900 deg. F. turbine capacity installed and another 3,000,000 kw. on order or in erection since the first went into service some five years ago, said Glenn B. Warren (General Electric), and he knew of no failures attributable to the adoption of this limiting temperature. Fortified as we now are with knowledge of metal behavior, he felt the present designs reflect sound conservatism. There is still plenty of difference in opinion about single-shell, tandem- and cross-compound designs, but it is wholesome and assures selection of the best choice for each particular situation.

Critical Queries

Thermal recovery schemes employed at Oswego are complicated and not generally applicable, said S. M. Arnow (Philadelphia Electric). Some are apparently more appropriate for higher load factor than the Oswego prospect. Complication in piping results from having the oil cooler in the basement and the hydrogen cooler on the operating floor. Sixth-stage extraction and an added heater save only 20 B.t.u. per kilowatt-hour and he doubted whether the possible $3,500 saved per year would support much of the thermodynamic refinement.

Sabin Crocker of Detroit Edison called the Oswego plant a proving ground for the 1,250-psi., 900 deg. F. cycle and he wished the authors had disclosed more reasons for the choice. Detroit has gone from 375 psi., 700 deg. F. (Trenton Channel, 14,000 B.t.u.) to 600 psi., 825 deg. F. (Connors Creek, 12,000) and to 815 psi., 900 deg. F. (Delray, 11,100 to 11,600 B.t.u.), and he questioned whether the apparent 10,700 to 11,100 B.t.u. for Oswego did not reveal a fruitless incursion into a region of diminishing returns. In fact, he intimated that the 815 psi., 900 deg. F. cycle was pretty hard to justify for a "hydro standby" plant with definitely lower plant factors than prevail on an all-steam system.

Optional refinements, Crocker said, have to pay for themselves in economical kilowatt-hours—the plant factor has to be high to pile up the kilowatt-hours. Study of Trenton Channel plant data showed a trend downward from about 45 to about 26 percent in sixteen years, with an average of 36 percent for 14,000,000,000 kw.-hr. output from a 300,000-kw.-hr. plant. Presumably it does not pay to design for initially advantageous plant factor.

In rebuttal, Cushing cited two casual arguments supporting higher pressure; three-quarters of the extra power for high-pressure feed pumping is returned as heat, the high pressure carries a relatively smaller condenser. He wanted to see Crocker's reasons for 800 psi. and then would record his for 1,250 psi. He said he was well pleased with the pioneering venture into electrodynamic fan-speed control, that he preferred the pre-measurement principle rather than the post-measurement principle of air-flow-steam-flow, that it took six hours to uncouple or couple the alternator for condensive operation.

Southwark Hydraulics

Hydraulic and pumping problems connected with the provision of condensing water from the Delaware tidal estuary for Philadelphia Electric's new 337,500-kw. (initial) plant at Southwark were discussed by S. Logan Kerr and Stanley Moyer. Each of the two units will require 146,000 g.p.m. A 1/10-in. improvement in vacuum would save 700 lb. of coal per full-load hour. The two-per-unit, 78-in. ID, 7-in. thick, reinforced-concrete pressure intake conduits 650 ft. long were placed on the relieving platforms of coal piers under the tracks and handling machinery. The pumps are immediately behind the traveling screens. Calculated velocity 5 fps.

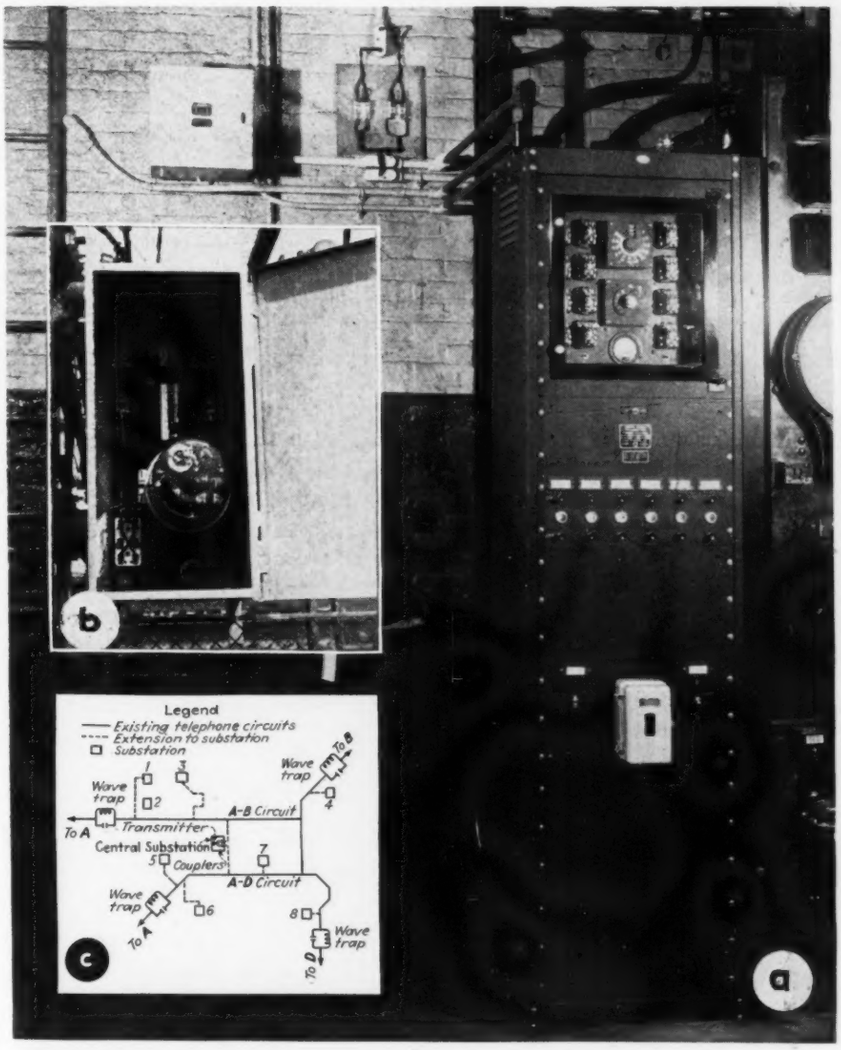
Temperature explorations showed that even a 0.1-lb. differential density of discharge was enough to bring the warm water to the surface within 300 ft. and therefore a bottom intake would escape recirculation; only a thin surface layer exists beyond 400 ft.

W. E. Caldwell expressed preference for a single two-speed pump over the two single-speed pumps selected because it could save 75 percent of the winter pumping power, a saving which could pay for larger pipe, etc., to reduce static head.

Wired Radio Controls Street Light Circuits

Radio signals, transmitted over telephone-dispatching wires, actuate "on and off" for eight outlying circuits — Offer blackout potentiality

FLOID M. FULLER, Pennsylvania Power & Light Company, Allentown*



STREET LIGHTS of Pennsylvania industrial community controlled by impulses from centrally located substation

(a) Transmitter. Timers, relays and signal output meter at top. Control buttons for six circuit groups at center. At bottom, time switch biases characteristics of photo-cell circuit in favor of earlier evening "on." Coupling equipment in box at left.

(b) Disconnect coupling equipment and arrester in line to "socket meter" receiver. Double-throw switch affords change to time-clock control.

(c) The wired-radio-impulse circuit.

IN A LARGE industrial city devoted primarily to defense work in eastern Pennsylvania the street-lighting circuits supplied from eight non-attended outlying substations are turned on and off by a wired radio control system operated from the central substation over telephone-dispatching circuits. Use of existing railway-dispatching telephone circuits materially reduced the cost of the control equipment and made feasible a control system which otherwise could not have been economically justified.

To indicate the time the lights are to be turned on and off on a light-intensity basis instead of on a fixed-time after sunset or before sunrise, a photo-electric cell is installed outside the substation and connected to a combination bell-and-light signal inside the substation. It has been modified by means of a time-lock transfer switch so that the signal operates at a lower intensity in the morning than in the evening.

Plug-in Mounted Receivers

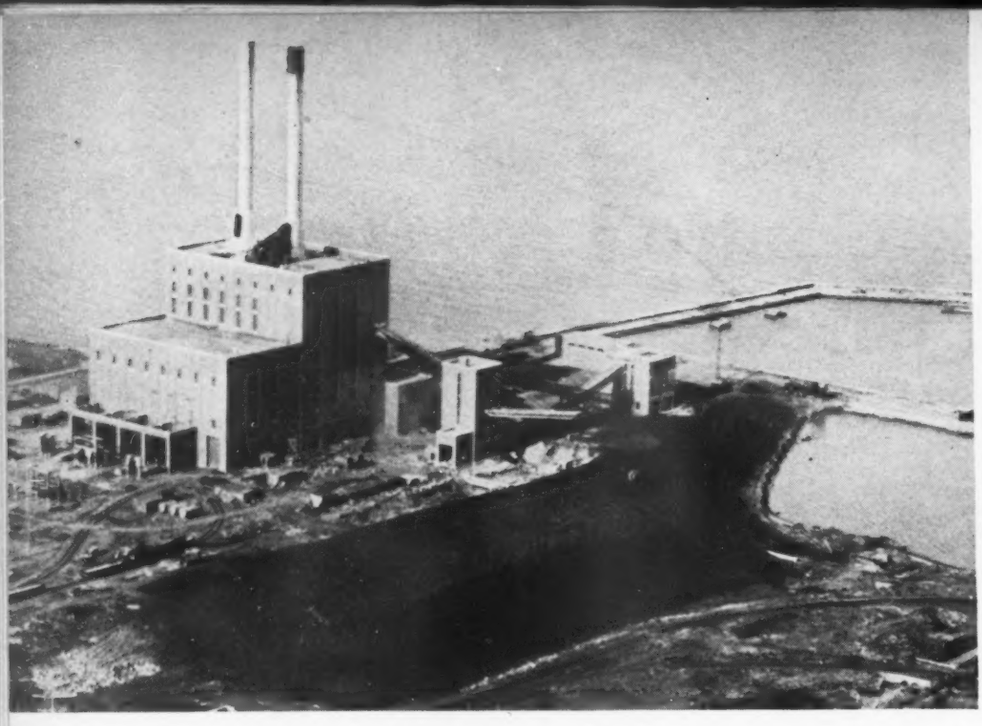
Carrier-frequency signal is supplied by a phono-oscillator amplified through conventional vacuum tubes. No power is used in the transmitter except during a control-signal cycle. When the operator presses momentarily the button corresponding to the operation desired the phono-oscillator is started, the filament power applied to the tubes and at the proper number of seconds later the plate power is applied and a coded signal sent out. At the conclusion of this the transmitter automatically shuts down.

The phono-oscillator is a small high-frequency generator driven by an 1,800-r.p.m. synchronous motor to give exactly 4,950 cycles. Output of this generator is amplified to give the power required to deliver a minimum two-volt signal at each remote substation. Capacitors are installed at the central substation for coupling the transmitter to the telephone lines.

Control units or receivers installed in each of the remote substations are mounted similar to a plug-in type of watt-hour meter and have a similar glass cover. The major parts are selector unit, signal relay, timer disk and motor and load switches and motor.

*Distribution engineer.

[*Continued on page 84*]



OSWEGO PLANT uses lake or harbor water for condensing. Two-unit station with two 200-ft. all-welded stacks. Rail coal enters from left. Water-borne coal delivered at harbor dock at right. Coal crushed, cleaned and weighed at breaker house before passed to bunkers or storage pile. Ash sluiced to fill lagoon adjoining north end of storage

Oswego Station Design Pioneers New Ideas

Six-stage extraction, extended automatic controls, preset sequence for air soot blowing, mobile equipment for coal-storage distribution, dynamatic fan-drive couplings, centralized control of safety valves and exciter used for motoring

SOME OF THE MORE significant points of departure about the new Oswego plant of the Central New York Power Corporation on Lake Ontario may be listed briefly as follows:

It is a unit plant (two 80,000-kw. units) of essentially vertical design with very few cross-connections; practically complete duplication of permanently connected auxiliaries; about 7,200 hp. in dynamatic couplings for fan drives; six-stage extraction; coal handling highly flexible, with LeTourneau carryalls and dozers to distribute around, trim and reclaim from the 500,000-ton capacity storage pile; air for soot blowing with preset sequences; major resort to automatic controls, recordings and centralized panels, with major reliance on air for actuation; floors (except main operating floor), largely left in grating form; cranes and monorails coordinated for maximum usefulness in maintenance work; all safety valves controlled from a panel on the operating floor; exciter used as motor for bringing generator to speed for condenser operation.

Designed for an ultimate capacity of 400,000 kw., the plant now has two General Electric 80,000-kw. turbines operating at 1,250 psi. and 900 deg. F., served by two Babcock & Wilcox 900,000-lb.-per-hour suspended boilers rated at 1,320 lb. and 900 deg. F. total temperature, the latter the largest so far of their type. No. 1 boiler has already furnished steam for producing more kilowatt-hours in a day than any other single boiler. All auxiliaries are electrically driven. Auxiliary power amounts to 6 percent of daily peak, a low figure for a 1,300-psi. plant.

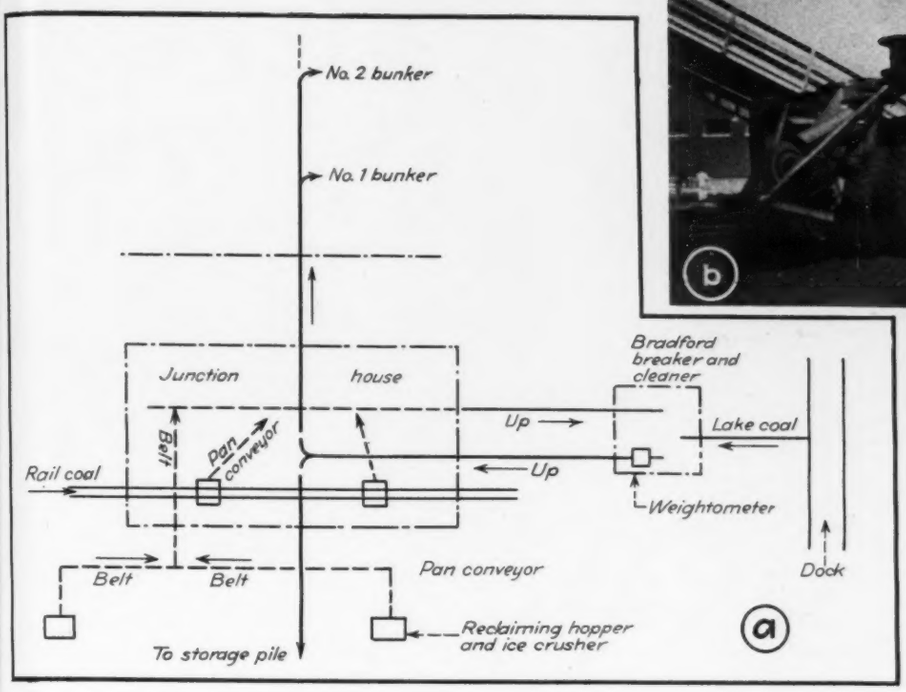
Condensing Water

Condenser water is taken from the lake through a tunnel passing under the harbor breakwater, the tunnel mouth being 20 ft. below lake surface. Recirculated water can also be taken in the winter months from the harbor inside the breakwater. Bristol recorders in the screen house show (1) the pressure differential across the Chain-Belt revolving screens and (2) the respective temperatures of lake water and harbor water.

Each turbine has a 58,000-sq.ft. single-pass Worthington condenser. ($\frac{7}{8}$-in. Admiralty tubes) with steam jet air removal equipment with inter-, after- and tertiary-condensate-cooled condensers.

Coal Handling

Coal is received in 4,000-ton capacity self-unloading colliers and in hopper-bottom rail cars, two of which can be emptied simultaneously. Coal can be handled at the rate of 600 tons per hour, either in delivery to the bunkers or into or out of storage, by the 42-in. Hewitt Rubber belts in conjunction with the pan conveyors



FLEXIBILITY marks coal-handling facilities

(a) Self-unloading 4,000-ton boats (right) or rail cars (left) deliver fuel to the breaker house and thence to pile or bunkers. After crushed coal is delivered by the belt-boom to the edge of the pile, carryalls and dozers distribute it over the pile and reclaim it. The boom has a telescopic chute which extends down to the pile surface to minimize the circulation of dust.

(b) 23-cu.yd. LeTourneau carryall, loaded and unloaded by the operator on the 96-hp. Diesel tractor.

under the reclaiming hoppers, the automatic sampler, Redler conveyor, Knittel crusher (on the bypass to the Bradford-Hammermill breaker). That the handling is highly flexible can be seen from the accompanying diagram.

Three Caterpillar tractors are used, with Model CK-8 LeTourneau angle dozers and two Model W 23-yard carryall scrapers to spread the coal, trim the pile and reclaim from storage as well as to help compact the coal against fire hazards.

Only three sizes of motors are employed in the coal-handling system and they are so chosen as to have one of the less essential motors available as a spare against a more essential one.

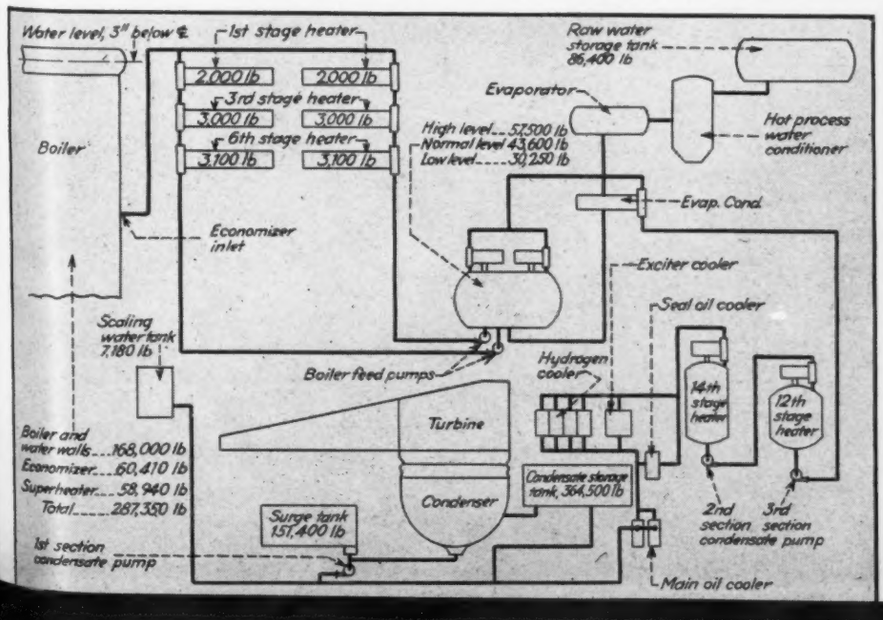
Feedwater

The Roe system of regenerative feedwater heating is employed. Six extraction points are provided at the turbine (stages 1, 3, 6, 9, 12 and 14). This unusual number was adopted in an effort to improve station economy and to reduce water cutting of turbine blades under varying load. Steam is still much the lesser part of Niagara-Hudson generation and is expected to function efficiently under widely varying load to accommodate variable availability of hydro. Improvement in station economy is obtained further by combining open type heaters and the three-element form of condensate pump. The oil cooler, hydrogen cooler and seal-oil cooler are inserted in the chain of heat-recovery elements comprising the open and deaerating heaters.

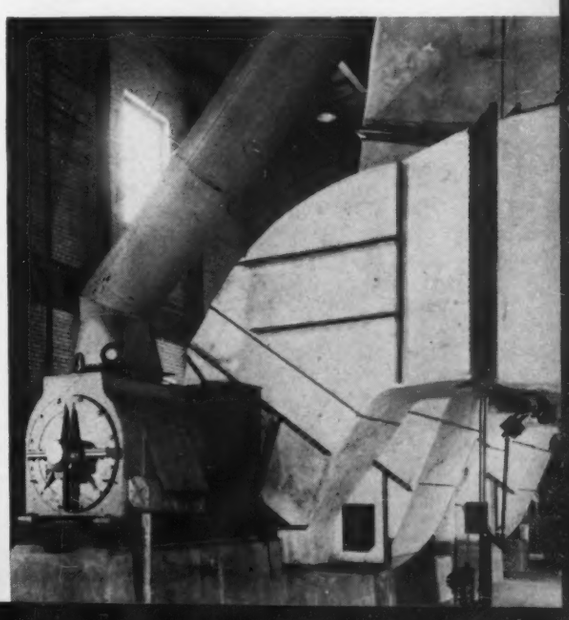
Makeup is hot-process softened in a Cochrane 3,600-gal.-per-hour deaerating tank. Evaporators float on bleed line varying from 14 to 45 psi. and the softeners are designed to give minimum disturbance to sediment under occasional vacuum operation. Lime-and-soda-treated water is de-

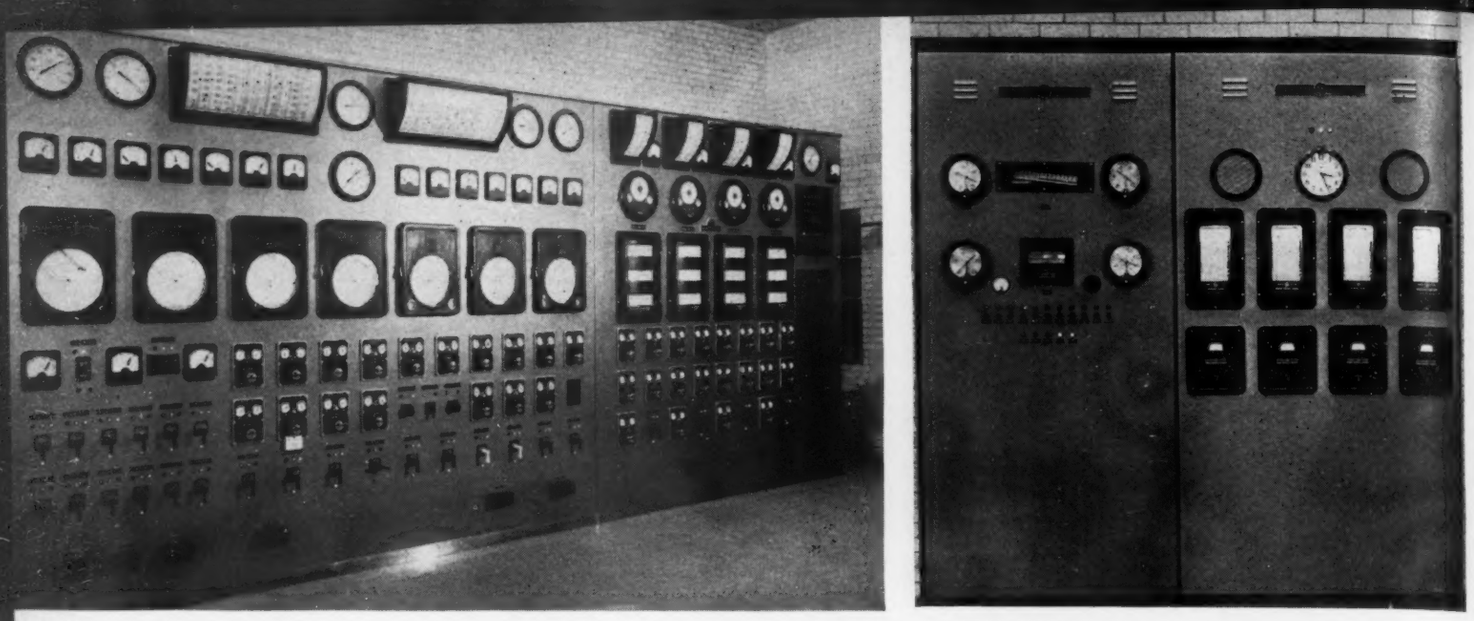
SIX-STAGE regenerative feedwater heating by the Roe system

Three-section pumps, incorporated in a common shell, pump the condensate through the Foster-Wheeler 14th-stage jet-type and the 12th-stage tray-type contact deaerating heaters (with 0.3 c.c. oxygen per liter guarantee) to the Cochrane 913,000-lb.-per-hour deaerating tray-type (436,000 lb. capacity) storage heater delivering zero-oxygen content water to the Ingersoll-Rand boiler feed pumps. These latter pumps send the condensate through three stages of Griscom-Russell high-pressure closed heaters fed from turbine stages 6, 3 and 1.



DYNAMATIC COUPLINGS on induced-draft fans. There are four of 1,250-hp. rating. Each has 90 percent speed adjustment





BAILEY boiler-and-turbine control panel for unit No. 2. At extreme right, beyond four unit-pulverizer controls, is the annunciator and below it the Autocall panel for setting sequence for automatic air-blast soot blowing. In view at right is the hydrogen control and turbine supervisory panels. Pressure and purity of the hydrogen in the generator and status of its controls shown on left-hand panel. Loudspeaker on right-hand supervisory panel can be turned on to amplify unusual sounds in turbine

canted to a separate compartment, where phosphate is introduced.

A small 3,600-r.p.m. feedwater pump is provided for starting up, in addition to the six (three per boiler) 550,000-lb.-per-hour eight-stage, 3,600-r.p.m. Ingersoll-Rand boiler feed pumps with horizontally split casings.

The high-pressure pumps are driven through 2:1 step-up herringbone gears (Turbine Equipment) by 1,800-r.p.m. induction motor with American Blower variable-speed hydraulic coupling to give 22 percent range of speed reduction.

Three-element Bailey Meter feedwater control is applied to maintain levels in the boiler drums and deaerating heaters (source of boiler feed pump suctions).

Combustion

One of the notable features of Oswego is the pioneering adoption on a large scale of electromagnetic couplings (Dynamatic Corporation) between the Buffalo Forge fans and the fan motors. These couplings total over 7,200 hp., there are four of 1,250 hp. on the induced draft units, four of 400 hp. on the secondary air fans and four of 165 hp. on the primary air fans. The speed ranges of the fans are respectively 90, 75 and 50 percent under the automatic Bailey combustion control. This design of coupling was favored because of the quick response, wide range of speed and infinite number of speed steps obtainable. Retention of grating floors facilitates flow of inside air to the intake of the forced-draft fans.

Control of combustion, the boiler, the turbine, the soot blowing and practically all auxiliaries as well as of the outgoing 115-kv. lines is centralized in one control room. The electrical panel forms one of the three sides of a square, the two boiler-and-turbine control panels forming the two others.

Coal and air delivered to each pulverizer and its pair of burners are premeasured and their quantities are automatically controlled by the Bailey Meter system. This system also comprises control for superheat temperature, water level, condensate flow and control of the temperature of hydrogen for generator cooling.

Air for the automatic control and meter service is supplied by three Worthington 125-cfm., 100-psi. carbon-ring compressors. Much effort was expended in assuring clean air because success with air-operated controls hinges largely on this factor.

Boiler Features

Two Babcock & Wilcox 900,000-lb.-per-hour boilers supply the two turbines (without header interconnection) at 1,320 psi. and 900 deg. F. total temperature. Each has a 66-in. ID upper drum and a 30-in. ID lower drum. The boiler heating surface is 7,307 sq.ft.; furnace volume is 43,520 cu.ft.; primary and secondary walls afford 9,779 sq.ft. of heating surface; armored blocks provided for primary furnace floor and secondary furnace wall observation lanes. There is a 26,900-sq.ft. steaming economizer for each boiler and two 237,750 sq.ft. tubular air heaters for primary and secondary air. The latter have dampers to bypass, second and third air passes to regulate the exit gas temperatures to keep just outside the corrosion limit of temperature. These accessories are all Babcock & Wilcox.

Forty-eight cyclone separators in the upper drum serve to convert the kinetic energy of steam and water entering the drum into the useful function of separating them so that only solid water is returned to the heat-absorbing surfaces to pick up further heat and only dry steam is passed to the superheater.

No external metal casing is provided, nevertheless the radiation loss is exceptionally low for a boiler of this size. The hand can be held comfortably on the insulation of the primary furnace with only 8¼ in. of water wall and insulation between it and the inside of the furnace where the temperature is in the order of 3,000 deg. F. This is attributable to the use of Johns-Manville mineral wool blankets and plastic insulation.

The safety-valve installation marks a decided advance in protection to the superheater and the turbine and provides for remote control of all valves from the operating floor. Any safety valve can be popped at will by the operator by means of the Crosby system which affords pilot safety valves to obtain 1 percent blowdown, to reduce boiler outages required to maintain safety valves and to obtain remote control for the actuating cylinders of the main safety valves.

Gas passage is provided between the two pendant superheaters of each boiler. Each one-half has 12,650 sq.ft. of heat surface. The design is of the non-draining type and one of

the problems remaining to be solved is the removal of water from the bottoms of the loops to insure minimum attack of the highly active distilled water on the inner metal during extended periods of shutdown. No difficulty was experienced in air-blowing residual water out when the whole volume of the boiler was available to afford air-storage cubic capacity, at the time the steam lines were cleaned with compressed air.

Overlapping horizontal loops from the two superheaters over the tops of the boilers in conjunction with vertical U-formations where the pipes converge to the Schutte & Koerting non-return stop-valves for merging into the common high-pressure (Kellogg welded, ½ percent molybdenum) pipe line to the turbine meet the expansion requirements.

A steam-sample degasifier (Cochrane) is installed on each boiler to separate the hydrogen from the steam for the measurement of the degree of dissociation of the high-pressure high-temperature steam into inert hydrogen and free active oxygen which causes corrosion of the tubes and drums. A Leeds & Northrup conductivity recorder registers the conductivity of steam sample from the drums and from the superheaters after they have been condensed and reduced to atmospheric pressure by a 60-ft. run of bore $\frac{1}{16}$-in. capillary tube.

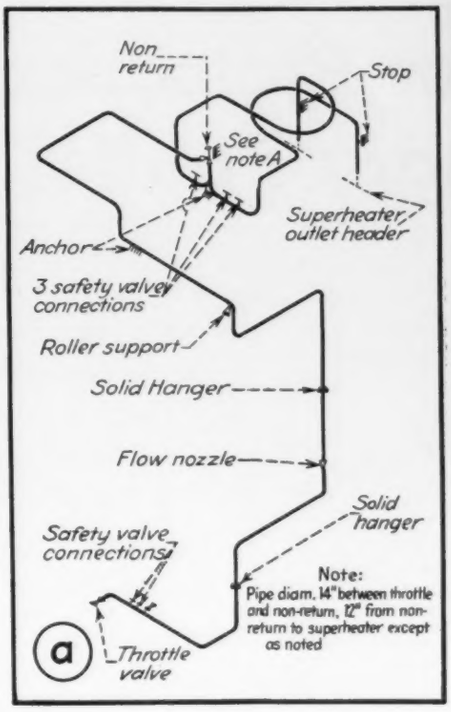
Incidentally, another conductivity recorder (Esterline-Angus) is provided to reveal the existence and degree of condenser leakage. Its indications also give information to diagnose possible carryover in conjunction with the steam conductivity meter.

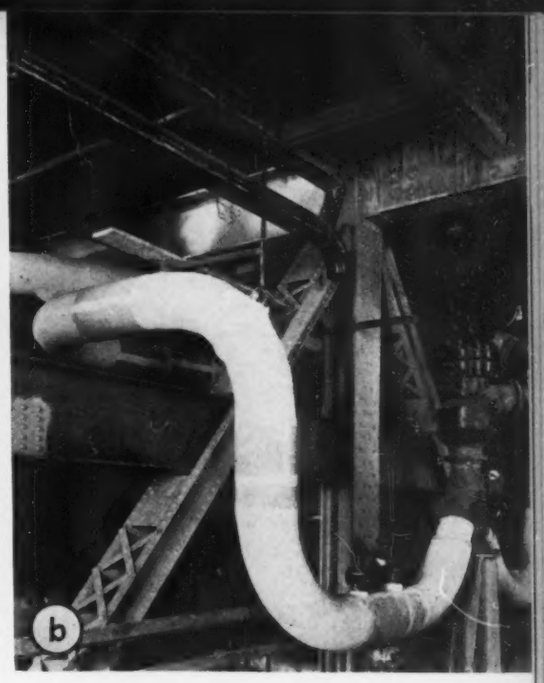
Preformed insulation (Union Asbestos & Rubber) was used for the 14-in. high-pressure lines, a size believed to be larger than previous practice.

Removal Functions

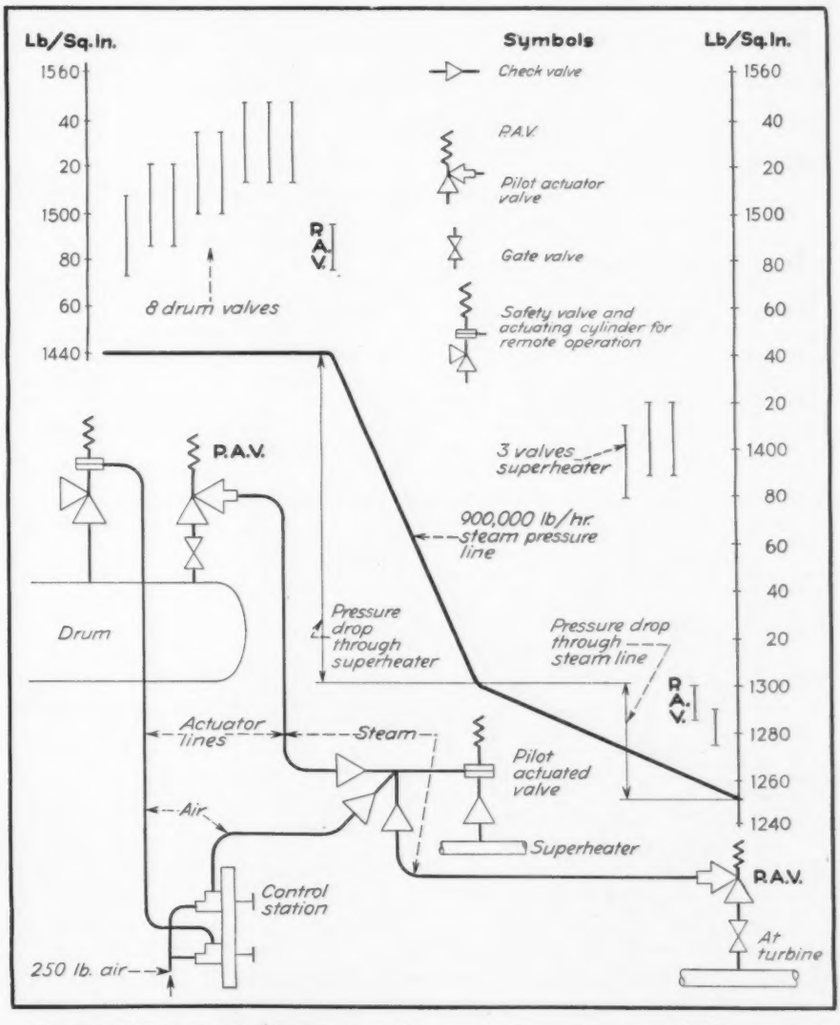
Instead of the customary practice of blowing soot with steam, the water walls and gas passages of the steam generators are cleaned with 250-psi. compressed air supplied by four 500-psi., cross-compound, 500-cfm. Ingersoll-Rand air compressors direct-connected to 200-hp. synchronous motors. After the first soot blower has been put in operation by

[*Continued on page 147*]





U-BENDS in superheated steam lines take care of expansion. Typified by the bends at the Schutte-Koerting 14-in. boiler stop valve



SAFETY VALVE ARRANGEMENT enables any valve to be popped from operating floor and in case of sudden loss of load gives more than usual protection (1) to the superheater against overheating and (2) to the turbine equipment against high pressure

Transformer Protection Timed for Secondary Faults

Set of curves devised to correlate transformer-protection fusing and breakers with household fuses and breakers for typical size, length and character of service

BRUCE O. WATKINS,* Rural Electrification Administration

PROTECTION of distribution transformers against faults on the secondary and the coordination of such devices with household fuses and breakers depend upon the size and make of transformer, the size, length and type of service and the type of protective device considered. Various devices, such as fuses or breakers, external, or internal, and located in the primary or secondary, are used. Some transformers are furnished with internal secondary breakers, which are already set at the factory. In these cases the protective limitations, if any, are set by the size and length of service and the size of transformer. This discussion will outline methods of determining type and rating of the requisite devices. Protection of transformers with banked secondaries is not considered.

*Head, operating problems unit, Technical Standards Division.

Explanation of Use of Curves

Fused Protection: Example 1

Given: A transformer size and connection, number of service conductors and a make and size of fuse.

Find: The maximum length of service for adequate transformer protection.

Procedure: Replot Fig. 2 for the particular size of the transformer considered and superimpose this curve on the total clearing time curves for the make of fuse to be used, as shown in Figs. 3a and 3b. (If the service is three-wire, each secondary winding is only rated for half capacity, and hence for *primary* fusing on a 120-volt secondary fault, the primary rating is only half the nominal rating, and one-half the rating is used in plotting the curve). Read the *time* at the point where the transformer curve crosses the curve for the size fuse selected. From Fig. 2 at this time read the times normal fault current. Now proceed to Fig. 1ab, whichever is applicable, and from the value for times normal fault current so selected find the service distances for the particular size transformer and the various sizes of conductors.

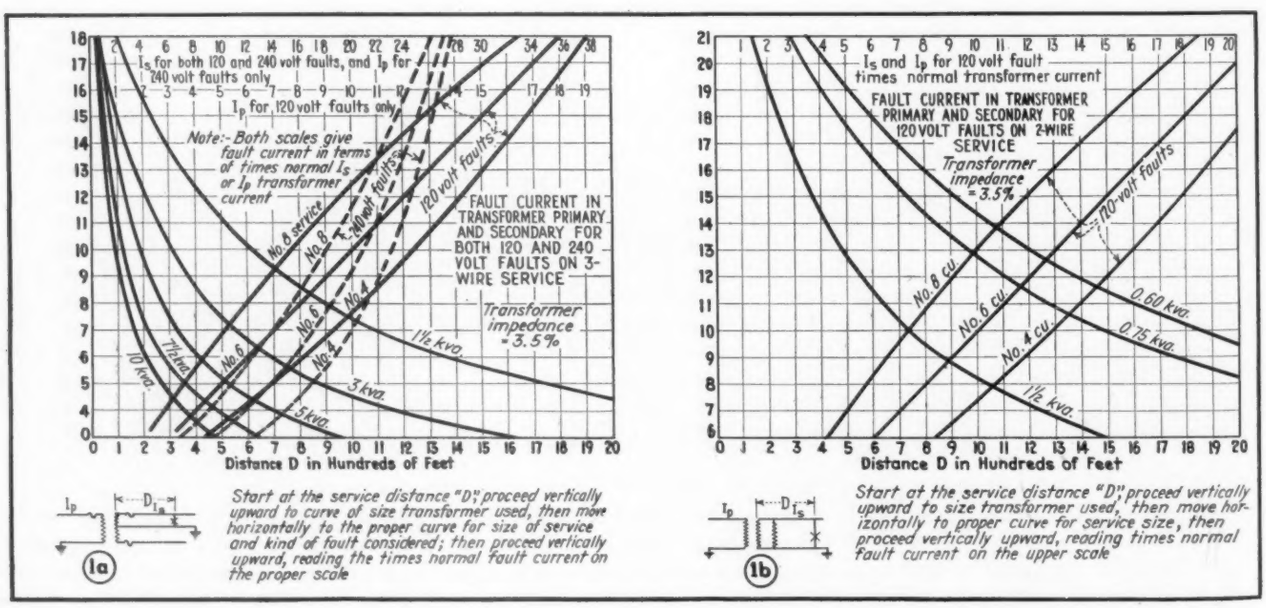
Note—For primary fusing test for 120-volt faults on a three-wire service. For secondary fusing, test for both 120- and 240-volt faults on a three-wire service and use the lesser value of service length.

Fused Protection: Example 2

Given: A transformer size and connection, the number, size and length of service conductors and the make and size of fuse.

Find: Whether or not proper protection is afforded.

Procedure: From Figs. 1a or 1b, whichever is applicable, find the times normal fault current for the given size, length and


Is for both 120 and 240 volt faults, and Ip for 240 volt faults only
Ip for 120 volt faults only
Note:- Both scales give fault current in terms of times normal Is or Ip transformer current
FAULT CURRENT IN TRANSFORMER PRIMARY AND SECONDARY FOR BOTH 120 AND 240 VOLT FAULTS ON 3-WIRE SERVICE
Transformer impedance = 3.5%
No. 6 service
No. 8
No. 6
No. 4
240-volt faults
120 volt faults
10 kva.
7½ kva.
5 kva.
3 kva.
1½ kva.
Distance D in Hundreds of Feet
Start at the service distance "D", proceed vertically upward to curve of size transformer used, then move horizontally to the proper curve for size of service and kind of fault considered; then proceed vertically upward, reading the times normal fault current on the proper scale
1a
Is and Ip for 120 volt fault times normal transformer current
FAULT CURRENT IN TRANSFORMER PRIMARY AND SECONDARY FOR 120 VOLT FAULTS ON 2-WIRE SERVICE
Transformer impedance = 3.5%
120-volt faults
No. 8 cu.
No. 6 cu.
No. 4 cu.
0.60 kva.
0.75 kva.
1½ kva.
Distance D in Hundreds of Feet
Start at the service distance "D", proceed vertically upward to size transformer used, then move horizontally to proper curve for service size, then proceed vertically upward, reading times normal fault current on the upper scale
1b

Basic technique used is to compare the operating time of the protective device with the thermal characteristics of the transformer for the range of secondary fault currents to be expected. The first step is, therefore, to determine these fault currents. A set of curves, Figs. 1a and 1b, is helpful where there is a number of calculations to perform. The accompanying curves are drawn for a transformer impedance of 3.5 percent, 6-in. secondary spacing, and assuming an increase of 33 percent in transformer impedance for a 120-volt fault on a 120/240-volt service. Constant ratio is assumed between the resistance and reactance for all sizes of transformers shown, to get all curves on one sheet.

Determining Fault Currents

For other conditions, other curves may be drawn up by using the following method:

If the lower scale (the service distance) is called "A," the left-hand scale "B" and the top scale (times normal fault current) "C," the equa-

number of service conductors, and transformer size. For this value of times fault current, on Fig. 2, find the time for transformer damage. Multiply the times normal fault current value by the normal current to obtain the actual current. For the value of actual current on the clearing time curve of the fuse find the clearing time at this current. If this is less than the time for transformer damage, above, the fuse is safe.

Breaker Protection: Example

Proceed as above, except check not only for *minimum* fault current values but for entire range of fault currents to be expected, since breaker curve may cross transformer damage curve at more than one point. This can be checked by drawing comparative curves.

Primary and Secondary Fault Currents, 7,200-Volt Primary, 240/120-Volt Secondary, Transformer Percent Impedance

120-Volt Fault on Three-Wire Service

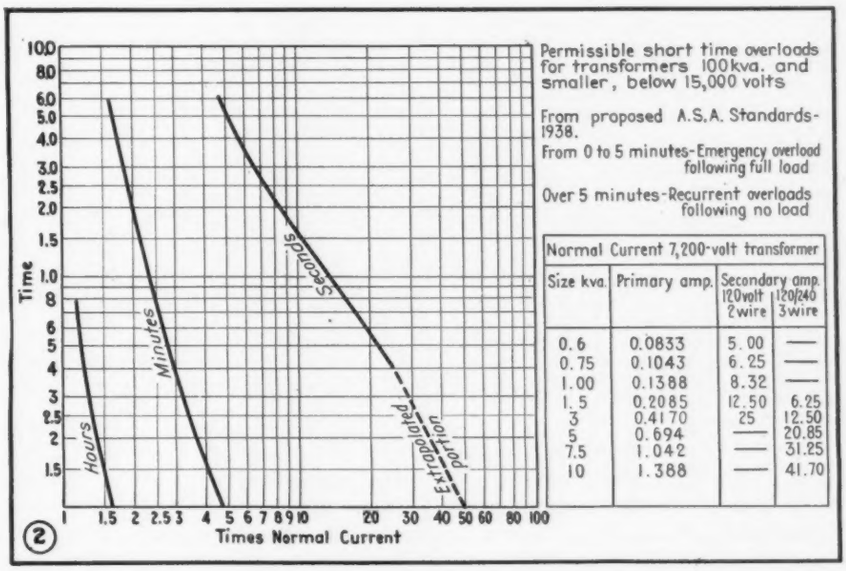
Transf. Kva.	2.00%		2.5%		3.00%		3.5%		4.00%	
	Pri.	Sec.	Pri.	Sec.	Pri.	Sec.	Pri.	Sec.	Pri.	Sec.
1.5	7.84	470	6.28	377	5.24	314	4.47	268	3.92	235
3	15.7	943	12.5	751	10.45	628	8.94	537	7.84	471
5	26.1	1,570	20.9	1,255	17.40	1,045	14.9	895	13.05	788
7.5	39.2	2,350	31.4	1,885	26.20	1,570	22.4	1,345	19.60	1,170
10	52.2	3,140	41.8	2,510	34.8	2,090	29.7	1,780	26.1	1,574

240-Volt Fault on Three-Wire Service

1.5	10.4	312	8.34	250	6.95	208	5.95	179	5.21	156
3	20.8	625	16.7	500	13.9	417	11.90	357	10.4	312
5	34.7	1,042	27.8	834	23.1	694	19.8	595	17.4	522
7.5	52.1	1,562	41.6	1,250	34.7	1,040	29.8	894	26.1	782
10	69.4	2,080	55.5	1,667	46.3	1,390	39.7	1,190	34.7	1,040

120-Volt Fault on Two-Wire Service

1.5	10.4	625	8.34	500	6.95	417	5.95	357	5.2	312
3	20.8	1,250	16.7	1,000	13.9	833	11.9	714	10.4	625
5	34.7	2,085	27.8	1,667	23.1	1,388	19.8	1,190	17.4	1,042
7.5	52.1	3,125	41.6	2,500	34.7	2,080	29.8	1,786	26.1	1,562
10	69.4	4,160	55.5	3,333	46.3	2,780	39.7	5,380	34.7	2,080



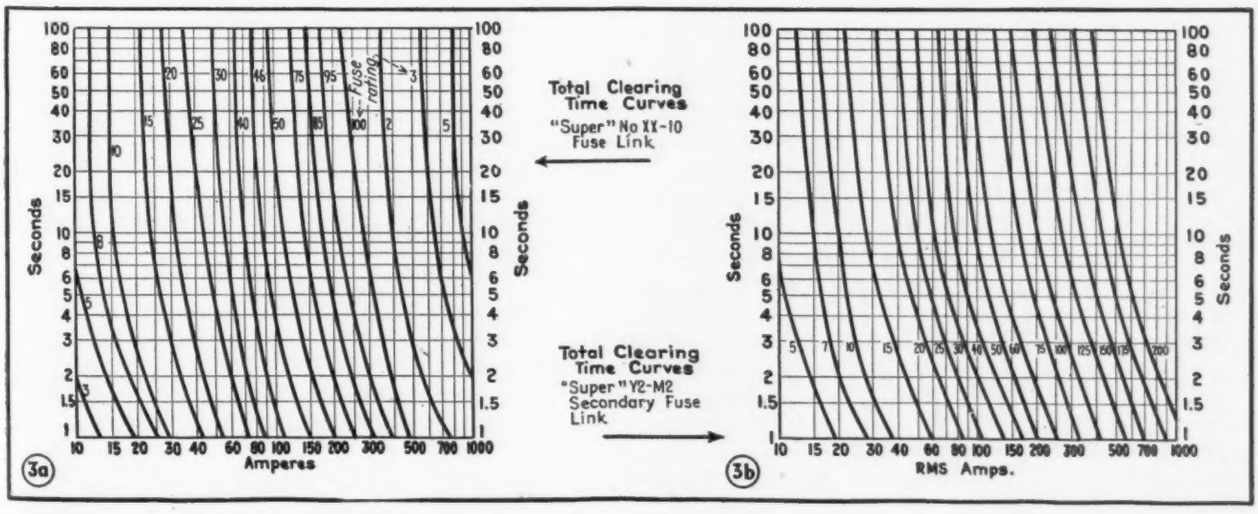
Permissible short time overloads for transformers 100 kva. and smaller, below 15,000 volts

From proposed A.S.A. Standards-1938.

From 0 to 5 minutes-Emergency overload following full load

Over 5 minutes-Recurrent overloads following no load

Normal Current 7,200-volt transformer			
Size kva.	Primary amp.	Secondary amp. 120 volt 2 wire	Secondary amp. 120/240 3 wire
0.6	0.0833	5.00	—
0.75	0.1043	6.25	—
1.00	0.1388	8.32	—
1.5	0.2085	12.50	6.25
3	0.4170	25	12.50
5	0.694	—	20.85
7.5	1.042	—	31.25
10	1.388	—	41.70



tion of the curves with transformer sizes indicated is

$$B=\frac{(Z_t + AZ_b)\, I}{E}$$

where Z_t=transformer impedance
Z_b=impedance of "base" conductor per unit service length
(Both impedances are expressed in complex quantities)
E=voltage
I=full load current

The equation of the "base" service conductor line is $B=C$, and is drawn at any desired angle, depending on the C scale to be used. The "base" conductor may be any desired conductor size.

Other conductor curves may then be drawn by calculating the fault current for different lengths of service, using a transformer of any one size.

For a transformer, resistance is equal to the copper loss, expressed in ohms, and the reactance can be calculated by taking the square root of the difference of squares of the impedance and resistance.

For example, if the copper loss = 40 watts on a 1½-kva. transformer, this equals 2.67 percent, or 924 ohms on a 7,200-volt base. Since the percent impedance is equal to the percent drop at unity power factor, full load, it can readily be calculated from the formula $P = \frac{100\ R}{100 + R}$ where R is the percent regulation at full load, unity power factor. For a three-wire, 120/240-volt transformer, with a 120-volt fault, the transformer impedance is between 25 and 33 percent higher than normal. Hence these values (particularly the resistance) should be increased by that amount in these cases.

Resistance and reactance values in ohms per 1,000 ft. per conductor for various sizes of solid conductor are as follows:

Cu Size	Resistance 20°C	Reactance 6 In.	Reactance 8 In.	Reactance 10 In.
1	0.1287	0.0899	0.0966	0.102
2	0.1625	0.0919	0.0987	0.104
4	0.2584	0.0992	0.106	0.111
6	0.4108	0.104	0.111	0.116
8	0.6533	0.110	0.116	0.122

For services, the impedance must of course be doubled for unit length. When using the primary voltage as the base, all impedances should of course be referred to the primary.

Primary Line Impedance

The curves (Fig. 1a and 1b) do not include either primary line impedance or fault resistance. If these are to be included, a separate sheet should be prepared for each transformer size. Since the curves shown are for 3.5 percent transformer impedance, which is higher than usual for small sizes, they can be used to approximate conditions with high primary line and fault impedance. For lower impedances the engineer can construct his curves, as above.

Fig. 2 gives the A.S.A. standard for permissible short-time emergency transformer overloads. This curve is based on experience with a large number of transformers, and is probably conservative. Some transformer manufacturers may claim variation in the allowable emergency overload for various designs. If so, the particularly applicable transformer characteristic should be obtained. With these curves and the characteristics of the protective device known, protection problems can be readily solved.

On any particular job, the engineer, knowing the kind and size of protection to be used, can easily make up tables of maximum service length distances for safe protection. Such tables can then be given as instructions to the stakers.

Limitation to the service length and conductor size may be due to regulation, and not to transformer protection. Regulation should be checked before a final decision is made on the service size and length.

Coordination

It is necessary to coordinate the house fuse or breaker with the tentative secondary protection chosen. The total clearing time of the house fuse or breaker must be *less* than the damaging time of the secondary fuse or breaker for *maximum* fault current.

For *maximum* fault currents the house may be at practically zero distance from the transformer. The accompanying tables give primary and secondary fault currents for different transformer impedances for 7,200-volt primary. By using the published time-current characteristics of the house protective device and the secondary protective device, with the proper fault current from the tables, coordination can be easily checked. (The damage time is about 75 percent of the *melting* time for a fuse. The total clearing time is the melting time plus the arcing time.)

To coordinate the secondary protective device with a primary fuse or breaker, compare the total clearing time of the secondary device on maximum secondary fault current with the damage time of the primary device on the same current, referred to the primary. The secondary current is referred to the primary by simply dividing the secondary value by the transformer turn ratio applicable in the particular case (see tables).

Acknowledgment is made to J. B. Hodtum, Allis-Chalmers Company, for many of the ideas in this text.

Wired Radio Controls Street Light Circuits

[*Continued from page 77*]

The first signal sent out in each control signal cycle is the "Start" signal. This starts the synchronous motor which drives the timer disk and once started it continues for one revolution of the disk in one minute. The "Start" signal is followed by an operation signal which occurs at a definite time interval after the "Start Signal." Each control-relay timer-disk carries an adjustable brass section which reaches the "on" or "off" brushes at certain definite number of seconds after the start signal, and if an "on" or "off" signal is sent when the brush makes contacts the relay operates and the lights are turned off or on in accordance with the signal sent. In this particular system there are six on and six off control buttons to operate the street-lighting equipment in eight substations. It was, therefore, necessary to put two substations on two of the control buttons.

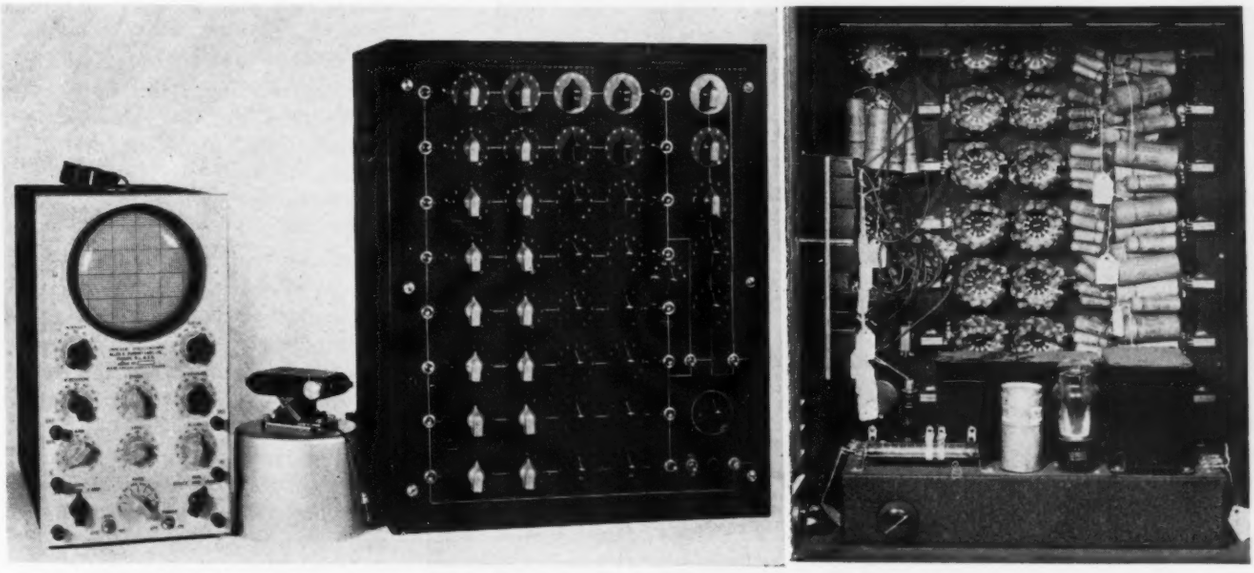
Prior to installation of the wired-radio control system the street lights supplied from the outlying substation were turned on and off by clock-controlled Sauter time switches. When the radio control was put in operation the motor switch operated by the clock mechanism on each switch was disconnected and the circuit connected to the relay switch of the receiving unit. Later it is expected to salvage the complete Sauter time switches and replace them with less expensive solenoid-operated oil switches.

All 2,350 lights for the entire community can now be lighted and extinguished at practically the same time. The control also provides a means for expeditiously "blacking out" the street lights should this be required either for trial purposes or due to an emergency.

Transient Analyzer Checks Breakers and Bus Protection

Measures d.c. transient to determine the saturation of current transformers for bus differential relaying — Ten equivalent branches of a complex network are set up — May be used for "transient" decrements of a.c. wave

J. H. NEHER and R. J. WOODROW,† Philadelphia Electric Company*



TRANSIENT ANALYZER with cathode-ray oscillograph and specially fitted camera. To operate the analyzer the camera, fitted with an auxiliary lens and special hood, is fitted over the screen of the oscillograph. Shutter opened just prior to closing the analyzer control switch and held open on bulb exposure until sufficient time has elapsed to secure desired transient. Time of exposure must be determined by examination of the transient before using the camera. At right is an inside view of transient analyzer

TRANSIENTS, particularly of a d.c. nature, are increasingly significant as potential fault currents grow in magnitude and approach breaker interrupting ratings, and as the speed with which faults are cleared is increased. The saturation, and consequently the accuracy, of current transformers used in bus differential relaying is a function of the magnitude and duration of the d.c. transient.

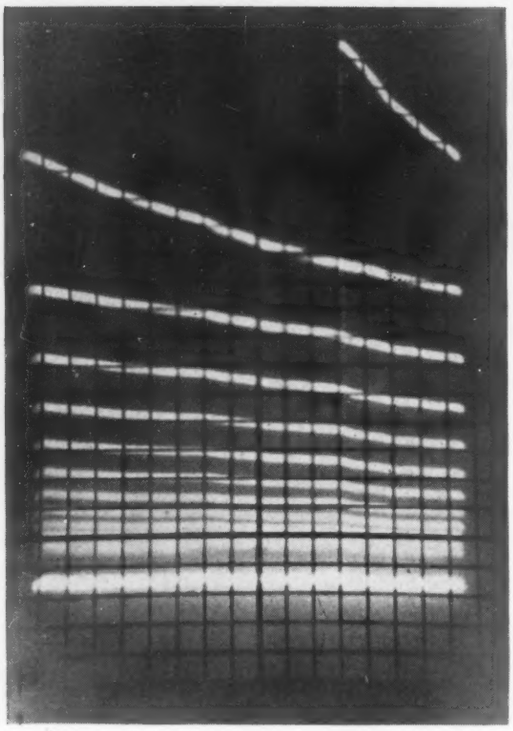
Transformers much less affected by saturation are soon to be generally available, but means are needed for verifying the characteristics of existing installations. For these reasons a transient analyzer has been constructed to determine the transients which will result on a power system with various combinations of equipment in operation, the characteristics of which are known. It serves adequately to avoid extended and laborious computations to obtain transient decrements. Since the magnitude of the initial value of the d.c. transient is very easily obtainable by conventional means, the analyzer is used only to secure the relative magnitude versus time values.

Duration, or "time constant," of the d.c. transient is a function of the d.c. resistance R and the negative phase sequence reactance X_2 of all the branches of a system network. It is found, however, that such a complex network can with sufficient accuracy be reduced to about ten equivalent branches. Each of these ten or less branches is set up on the analyzer in terms of a capacitance to represent R and a resistance to represent X_2. A d.c. voltage of 300 is applied to the equivalent network and the resultant transient current is recorded by a camera which photographs its trace on a cathode-ray oscillograph screen.

Branches Adjustable

Eight of the main branches consist of capacitors and resistors (see accompanying illustration for values)

* Senior engineer in charge of design.
† Engineer.



TRANSIENT as recorded by camera and resultant decrement curve

The d.c. transient is typical of a short circuit on the bus of a large generating station interconnected by transmission lines with a metropolitan system. The magnitude of the short-circuit current on an r.m.s. symmetrical basis is approximately 2,000,000 kva.

Typical Calibration Curve for Decrement

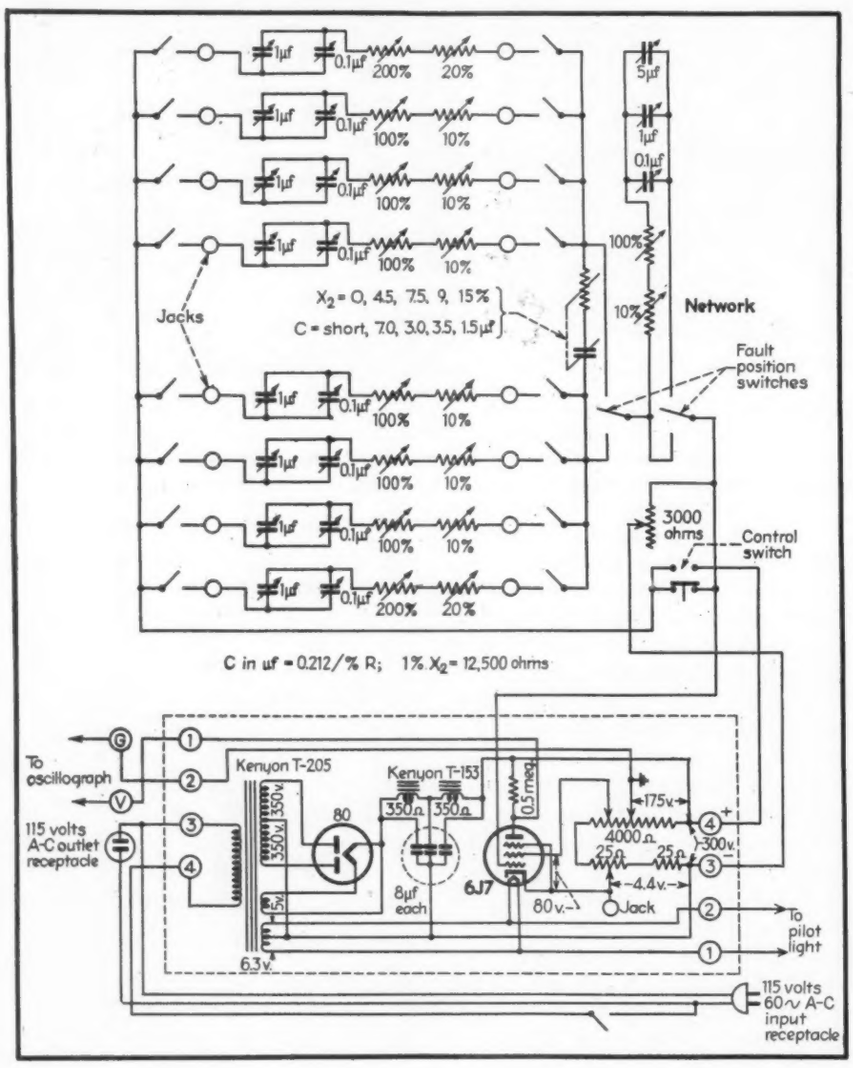
Cycles	Deflection	Volts	%
0	+0.76	0.495	100
3	—0.03	0.320	63
6	—0.30	0.250	51
9	—0.49	0.200	40
12	—0.62	0.160	32
15	—0.73	0.130	26
18	—0.81	0.105	21
21	—0.90	0.080	16
24	—0.95	0.065	13
27	—0.99	0.050	10
Oo	—1.16	0	0

adjustable in 1 percent steps. There are also a bus tie reactor branch and another branch to represent a series impedance, such as a line or reactor, to the fault. Additional flexibility of connection beyond that obtainable with the switches built into the analyzer is secured by the use of jacks and jumper plug connectors.

Non-linearity Compensated

Unfortunately, neither the horizontal time scale nor the vertical amplitude scale of the finished picture is exactly linear due to distortion of the optical system, non-linearity of the sweep circuit and non-linearity of the amplifier and cathode-ray deflection. However, all these difficulties are removed by photographing with the transparent scaled screen of the oscillograph in place, utilizing a vertical deflection calibration curve, and picking points of the transient all on the same vertical line of the picture. This results in a series of points, each a sweep interval apart, which can be plotted to give the resultant curve of the transient in magnitude versus time.

Utilization of the analyzer simplifies enormously the task of determining d.c. transients both for the calculation of current transformer saturation and for circuit breaker duties. If desired, it is also possible to use the analyzer for obtaining "subtransient" and "transient" decrements of the a.c. wave by applying a variable shunt resistor across all the capacitors representing sources and shunting out the capacitors representing simple impedance branches such as lines or reactors.



SCHEMATIC DIAGRAM of analyzer with direct connected amplifier

Values of circuit constants chosen to represent practically all conditions encountered on the system, but to simulate unusual cases the values of resistance can be multiplied by and the values of capacitance divided by a fixed constant. Closing of the analyzer control switch applies voltage to the source points of the analyzer and current passes through the variable shunt resistor shown on the diagram. The voltage measured across the shunt, which must be adjusted to give the desired deflection of the oscillograph beam, is amplified by a special direct-connected amplifier and applied directly to the vertical deflection plates of the oscillograph. The sweep frequency of the oscillograph is adjusted so that the transient appears as series of diagonal lines.

Range-Water Heater Combination Reduces Distribution Demand

Three-kilowatt load limiter is utilized — Flat rate for electric water heating service resembles telephone company methods — Range program developed out of 20 years of utility sales experience

W. S. FLEMING,* Nevada-California Electric Corporation, Riverside, Calif.

OUR DOMESTIC USAGE averages about 1,400 kw.-hr. per year and major appliance saturation is approximately 28 percent for ranges, 65 percent for refrigerators and 15 percent for water heaters. In a normal year, if there is such a thing, we sell about 500 refrigerators, 400 ranges, 300 water heaters, 250 washers and 100 ironers.

These results attained in our territory, which is 500 miles long and 60 miles wide and yet has only 25,000 residential customers, have not been due to any peculiar method of operation.

Instead, in the words of our general commercial manager, we simply have put on regular campaigns consistently every year and have driven hard for sales. After all, we believe that only hard work and intelligent handling will produce results, for we know of no short cut to high saturation.

*Merchandise manager.

Load Limiter

Our early efforts were confined entirely to ranges, but we knew a water heater could make an exceptionally good combination customer out of a very good range customer. However, our system was planned to provide specific transformer capacity to range customers and we could not provide the low flat rate water-heating service necessitated by competitive services if added system capacity were required.

To solve this problem we turned to a load limiter, installed on the range circuit and made by the Wesix Company in San Francisco. I believe that it is more or less a standard item with it, but that the setting which we use may be one which has been developed expressly for us. The range load goes through this load limiter at all times. Whenever that load reaches or exceeds 3 kw. the load limiter automatically opens the water heater circuit and the water heater stays off the line until such time as the load falls below 3 kw.

The reason we stop at a 3 kw. load is that we normally provide 3 kw. of transformer capacity for each range customer. The theory of the flat rate water heater is that we can serve it

The Nevada-California Electric Corporation

Abstract of Schedule DWH — Domestic Water Heating Service — Entire Territory

Applicable only to domestic water heating, where an electric range is installed, subject to special conditions hereinafter stated.

Territory

Applicable in the entire territory served.

Rate

Maximum Number of Residents in House	Capacity of Tank in Gallons	Capacity of Heater, Watts	Monthly Charge
2	18	1,500	$2.00
2	24	1,000	2.00
3	30	1,000	2.50
4	30	1,500	3.00
5	40	1,500	3.50
6	40	2,000	4.00
7	52	2,000	5.00
8	52	2,500	5.50
9	66	2,500	6.50
10	66	3,000	7.00

Special Conditions

(a) *Range:* This schedule will apply only to domestic water-heating service where the customer has permanently installed an electric range used exclusively for all regular cooking on the premises.

(b) *Water Heater:* This schedule applies only to water heaters sold and installed by the corporation, or to water heaters owned by the customer and installed at his expense, provided that such customer-owned water heaters comply with the following specifications:

1. The water heater shall be insulated with at least 4 in. of granulated cork or its equivalent and shall be of the full automatic type.
2. Heat traps should be provided in both the cold and hot water lines.
3. Wattage of heater and size of tank shall be limited to those stated in the rate.

(c) *Load Limiter:* Except in Rate Zone I, the range and water heater circuits shall be equipped with a load-limiting device, to be furnished by the corporation, which will automatically open the water heater circuit whenever the range load exceeds three kilowatts. In Rate Zone I the installation of such load-limiting devices will be made only at the corporation's option and expense.

(d) *Plumbing:* This schedule shall not apply to hot water systems using circulating coils, radiators or cold water return taps.

(e) *Rate:* The rate is determined by the capacity of the tank and capacity of the heating element, as set forth in the table under *Rate*, above, but the size of the original installation shall not be less than tank capacity and heater capacity corresponding with the number of residents as shown in that table.

without any additional transformer or service capacity, and this can be done only by keeping the water heater peak off the range peak. As you see by the schedule, the maximum wattage on any of our water heaters is 3,000, so that we still do not overload the transformer which was originally put in to serve the range load. Most of the installations are of even less wattage than that—normally running 1,000 or 1,500—so that we feel that we can stand the momentary 1,000 or 1,500-watt load on the transformer that normally occurs before the load limiter kicks off with a range load of 3,000 watts.

This rate has been in effect since 1934, and we as yet have no cases of transformer burn-out or any other thing that might indicate an overloading of service facilities.

Water-Heating Rate

As far as I know our domestic water-heating rate is unique, and since it has been such a help to us in our revenue building it might bear passing along. We attribute our high saturation of water heaters to it as well as our fairly good saturation on ranges, because in our set-up you can't have a water heater without the range, and the water heater is so satisfactory that they won't give up the range because they would have to give up the water heater too.

Our rate requires that the customer install and use an electric range before he is eligible for our flat rate water heater. This rate, as reproduced here, is a flat monthly charge similar to a telephone bill and depends upon the size and habits of the family. We have a very simple formula for arriving at the proper size for any given set of conditions (see panel) so that any one can use it with confidence.

The customer knows what the bill will be every month before he makes the installation, hence we never have any complaints. The charge starts at $2 a month for a minimum family and goes in easy steps to as much as $8 per month. Our average water heating bill is about $3.50 and worth much more, so we are told. The service is not metered and the only check on usage or wastage is the size of the element, which in the event of excessive use does not have the ability to recover fast and the customer runs out of hot water. For all reasonable needs there is ample hot water.

We install the load limiter on the range circuit, so that there can never be any more load on the facilities installed than would be if the water heater were not there. This, in our minds, justifies the rate and makes a very good customer without added cost or investment on our part. We have some 4,000 of these water-heater customers on our lines at the present time and many of them have been connected since the inauguration of the rate, more than six years ago, so that we feel we really have a trial period that reflects the satisfaction of the customer.

Sales Compensation

Early in our experience we learned that special drives kept our people more enthusiastic and produced more business than just straight selling. So for years we have had a regular year-round schedule of campaigns—with special prizes, terms, quotas, advertising, pep meetings, etc. A typical year looks something like this:

Washers and Ironers	Jan.	15 —	Feb.	28
Refrigerators	March	1 —	May	31
Ranges	June	1 —	July	31
Vacations	Aug.	1 —	Aug.	31
Refrigerators	Sept.	1 —	Oct.	31
Ranges and water heaters	Nov.	1 —	Dec.	31

The plan we have for paying merchandise salesmen is as follows: We pay our men a flat salary, furnish them a car and pay any legitimate expense in connection with their work, and an annual bonus. An annual quota is set for each of the men, which has always been $12,000 worth of sales net—that is, gross sales less repossessions. We have established this amount as that necessary to pay the salesman's cost to the company and his proportionate share of the necessary overhead. When the salesman makes this $12,000 quota he receives 1½ percent of it and 3 percent of all over that amount. The bonus is paid at the close of the calendar year, and unless the man is in the employ of the corporation at the close of the year he forfeits his bonus.

There is nothing at all complicated about the plan and yet it does seem to be satisfactory to the men who have stayed with it during the exceedingly lean, as well as the more bountiful, years.

Employee Selling

Until a few years ago we paid "tip money" to all employees for prospects that developed into sales. For a long time this method insured us of 100 percent cooperation from our non-selling employees. Then conditions changed, so this plan was abandoned, but as far as we are able to see it has made no difference in our employee cooperation in any way. Those that cooperated before still do, and to just as great an extent.

[*Continued on page 150*]

The Nevada-California Electric Corporation

Plan for Determining Water Heater Size — Effective November 15, 1937

The following plan must be followed explicitly in determining the proper size of the installation to be used or sold on our C-8 flat rate water-heating schedule. Please keep this where it may be readily accessible. To determine heater size, add the following:

2—for first person in the family.
1—for each additional person in the family.
2—for each servant.
1—for each bath over one in the house.
1—for electric washer (laundry done at home).
1 to 2—for habits of family.

The total then gives the water heater number that must be used. This can be stepped up any amount agreeable with the purchaser, but must not be lowered as service will be inadequate and complaints will follow.

Example (a): To determine size of heater for a family of three having no servants, using their own washing machine and in *ordinary* circumstances:

2 for first person	2
1 for each additional person	2
No servants	0
One bath	0
One electric washer	1
	— 5

A No. 5, 42-gallon, 1,500-watt water heater would be required.

Example (b): To determine the size of the heater required for a family of five, with one servant, two baths, no washing machine, but *average* in circumstances:

2 for first person	2
1 for each additional person	4
2 for each servant	2
2 baths	1
No electric washer	0
Habits of family	1
	—10

A No. 10, 66-gallon, 3,000-watt water heater would be required.

Suspended Buses Carry Heavy Current

Suspended buses used in various forms since 1898 to carry power to aluminum plants utilize inertia of bus assembly to absorb mechanical forces arising from short circuits

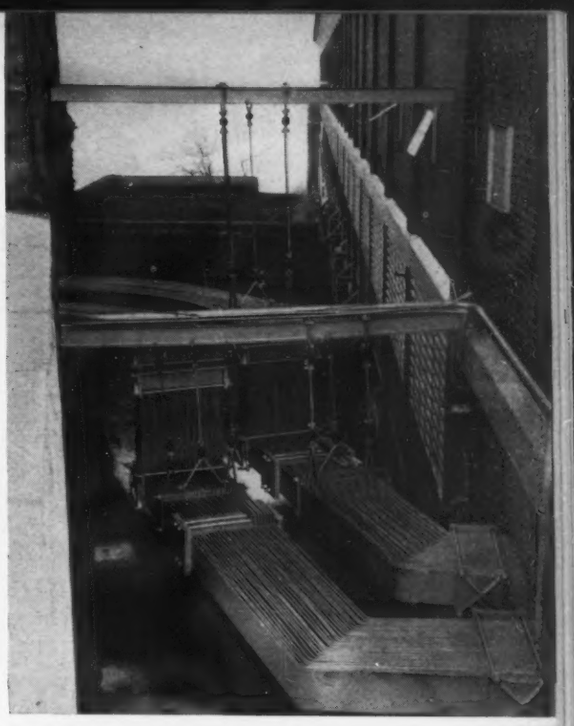
L. N. GREER and L. T. GUESS, Aluminum Co. of America, Pittsburgh

EXPERIENCE of the Aluminum Company of America has shown that the simplest and most economical method of supporting heavy-current buses is to suspend them from strain insulators. Accompanying illustrations show the evolution of the suspended bus idea in plants of the company from 1898 to the present.

Value of the suspended bus construction lies in the simplicity of the supports. When short-circuit currents are high the conventional method of mounting buses requires exceptionally rugged and expensive supports, since the full force of the short circuit must be absorbed by the rigid structure. In the suspension type construction the impact on the support is avoided since the energy is absorbed by the inertia of the entire assembly and the resulting swing.

Medium-voltage a.c. yard lines and distribution lines are not much of a problem for the average industrial plant since the load can usually be served by using standard distribution cable arrangements. In the aluminum industry, however, the unprecedented plant expansion and the adoption of heavy alternating-current equipment has put exceptionally high demands on these lines. How this condition was met at Alcoa is shown in one of the pictures and caption.

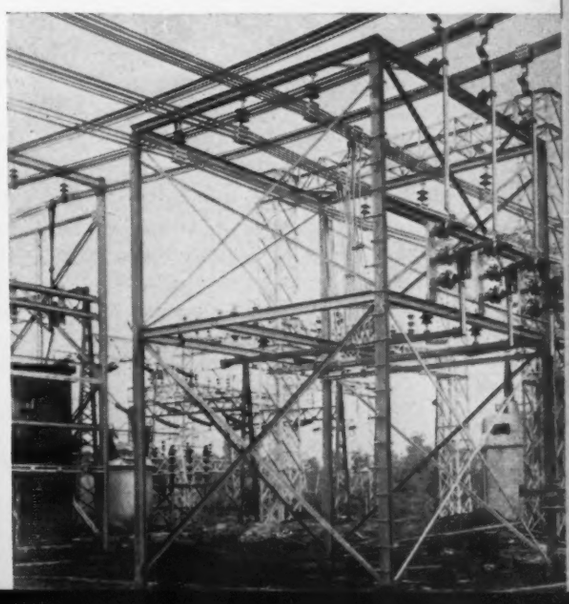
While multiple-cable suspension buses are giving good service, the more recently installed buses, like the one supplying the new plant at Vancouver, Wash., have utilized aluminum channels in suspension. The channel is particularly adaptable to long span suspension bus construction because of the lateral stiffness of the rolled structural shape. Taps and connections can be more easily made on this type of bus. Thus it is possible to combine the advantages of busbar construction with the simplicity of the suspension arrangement for carrying heavy currents encountered in modern industrial distribution systems.



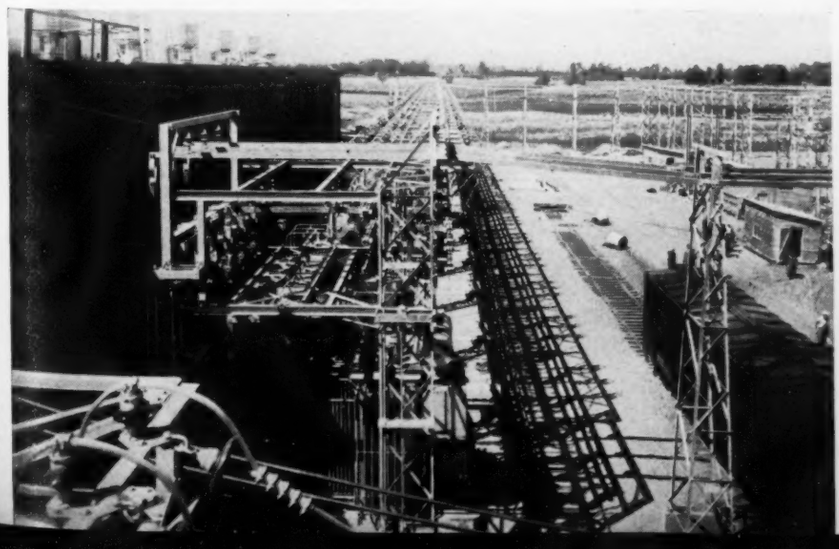
SUSPENDED BUS installed at Niagara Falls plant in 1898 now carries 60,000 amp. continuously at 600 volts. Has operated satisfactorily for 40 years

AT MASSENA, N. Y., 1,000 ft. d.c. transmission line built in 1904 carries 100,000 amp. at 560 volts through 2,240 ⅜-in. aluminum rods bundled and suspended from structures 75 ft. apart

MULTIPLE-CABLE BUS for 13.2-kv. distribution line built in 1916 at Alcoa, Tenn., used four to nine 1,033,500-cir.mil cables per phase in 65-ft. spans



RECTIFIER STATION of the new aluminum production plant at Vancouver, Wash., built in 1940, employs suspended 5-in. aluminum channels to distribute power to transformers which step it down to 1,000 volts for rectifier transformers; 25-ft. spans



Do They Read It?

You cannot be sure that they do, but you can be sure that customers don't read the bill insert if you don't keep trying to make it more attractive and appealing

C. J. ALLEN, Director of Public Relations, Connecticut Light & Power Company

DO YOUR CUSTOMERS read the bill insert which you ever so carefully plan? If they don't, what does it matter that six vice-presidents have approved it and you think it's swell copy, or even that you were able casually to tell your wife's relations that it won a national award? Surveys don't always tell the complete story, and anyhow you can't be eternally measuring your advance or you'll have little time and money left with which to advance. So the advertising executive keeps ever in mind the questions: "Will my customers read it? Sure it's good copy, but what can I do to enlarge its reader acceptance?"

An Opportunity

Utility companies, department stores, hardware dealers, in fact nearly every type of business nowadays, visualize the monthly bill as a no-charge opportunity to send a customer message. Even the hospitals are now mailing out hospital plan booklets with their bills, and we won't be a bit surprised if the doctors and dentists move in next. Maybe they have—we haven't had our tonsils or teeth worked over lately.

But much bill insert material gets a low reader rating. And many times that's just what it deserves. Often have we observed our lady open an envelope over the household wastebasket and with practiced fingers extract the department store's monthly bill, letting a small shower of booklets and notices flutter into her lovely aqua-blue—it matches the wall paper—basket. The advertising people were crowding the mourner and the mourner simply buried the body without bothering to hold a wake.

So most of us have found out—you have to cut it short. We've learned not to try to pack too much punch into one swing. And if we can personalize our bill insert and make as sure as we can that it has an eye-arresting attention attractor, there's a good chance that the prospect will read the important monthly messages.

The Connecticut Light & Power Company's monthly bill insert, *The Connecticut Light News*, is a small (5 x 7½) four-pager, the front cover usually made up of an all-over photograph designed to catch the eye of the prospective reader. Always the caption is brief, although we strive to put across a punch-packed message—what our company's doing to support national defense, to promote better living, and the like.

Timely Tie-ups

We inject the topical into the cover; for example, in our November issue we used an illuminated scroll setting forth the reasons why, as citizens of the state and nation, "We give thanks." In a recent issue we played on the now so important note of national defense with a photomontage cover of a lineman, an army private and a navy lieutenant, the latter two being employees now in the service. The caption briefly summarized the story that all three are equally serving their country.

The first inside page is the message page. No, we don't like that word "message" any better than you do, but you know what we mean. On this page appear newsworthy stories of company operations, such as the recent "State Officials Break Ground for Power Plant Addition." Shortly after a company team had won a state first aid championship we featured a first-aid story. This page carries brief articles giving hints on how you can get the most comfort and efficiency from your electric service, or perhaps our old sticker, the kilowatt-hour, will be redefined in layman's language. These few of the many ideas used will give you some idea of the kind of copy used.

Local Appeal

This, second inside, the "Household Helps and Recipes" page, is at once our women's page and our localizer. It is the page by which many women customers come to know the bill inclosure, and because it has a picture of the *local* home service representative in the center of the page, with her name directly below the cut, it serves to angle it locally. Although the copy is the same for all districts, the individual pictures of each of our thirteen home service representatives are used, helping to remove the canned copy course through the pleasant medium of a home-town girl.

For the Christmas issue we leave out the "Household Helps and Recipes" page, replacing it with a personal message of greeting in letter form from each of our managers. Although the same copy was used in

each of the thirteen districts the letter was signed by the local district manager, and his captioned picture was used in the center of the page in the location usually occupied by the home service representative.

Looks Personal

Our territorial line-up apparently eliminates the probability of the similarity of copy being noticed in different districts. Our managers received many complimentary comments on their 1940 Christmas greeting, a comment to one manager being, "You didn't need to have your name and picture on that letter. I recognized your style the minute I read it."

The back cover is devoted to promotional advertising, using not the conventional type, but brisk editorial style copy. Rates and terms of sale are seldom mentioned, the stress being on the convenience, comfort and economy of electric appliances. Illustrations are freely used, not of the appliances as may be seen in the show window, but in actual use in the home.

We do our own picture-taking and the engraving is done by a local concern. Only the knowledge that a vigilant editor is on the alert for plugs prevents us from naming the Meriden printer, whose excellent, reasonably priced work is proof that you can do all right by yourself on the small town printing circuit. Actual printing and engraving costs amount to less than 5 cents per customer per year, each customer receiving twelve issues. A supply of the current insert is kept on all our cash counters, and more customers than you think pick them up and take them home. This is a good indication of customer interest.

Customers Respond

Because we're anxious to improve our bill insert we are constantly looking for suggestions and help. We've loudly announced to both customers and employees that we'd like any comments or suggestions and that we welcome rocks as well as roses. And we've received and welcomed many helpful criticisms and suggestions. And every once in a while a thoughtful customer says or writes some words of praise. We used to get occasional criticisms of our recipes, and after an especially biting one from a woman customer who wanted to know where you got the money to buy the six woodcocks she needed for one of our recipes, we decided to let the male copywriter confine his activities to the other pages. So now our home service girls take turns on the recipe page.

The Connecticut Light News
AUGUST, 1941
DEFENSE LINE
SAFETY AND SERVICE
FIRST AID
HOME SERVICE Notes
Household Helps
Recipes of the Month
Mixed Fruit Punch
JUNE, 1941
In The Good Old Summertime
Jeweled Accuracy
Thirteen to One
Help at Home
We give thanks, in the traditional and humble manner of New England, for our heritage of freedoms — freedom of religious worship, freedom of speech and freedom of the press.
We give thanks that we reside in a State which is united with other States in mutual respect and friendliness, unmindful of relative sizes or strengths; united for peace and, when necessary, for the defense of that peace.
We give thanks that, in our own precious democratic way, we can prepare ourselves to defend our freedoms for ourselves and children.
We give thanks that our children go to school, that they sleep at night without fear, that they walk and run and shout and laugh, that their hunger can last only until the next mealtime.
We give thanks for the bountiful resources of our Nation and for the American ingenuity which makes possible their use for our benefit and for the benefit of the world.
We give thanks for our American way of life to which the laborer, the skilled craftsman and the executive each contribute a share and from which each gains the highest standard of living yet known.
For these things we give thanks.

TYPICAL COVERS and inside pages of Connecticut Light & Power bill insert which is designed to get and hold customers' attention by responding to their interests in current conditions and in home affairs

Our aim is to get out a bill insert that all our customers will find interesting enough to read from the top of page one to the bottom of page four. We know we're not doing that, but we're in there trying, and we guess nobody can hate us for that. Least of all the customers who give us our daily bread and oleomargarine.

Editorials

S. B. WILLIAMS, *Editor*

War Will Bring Management and Labor Together Again

ONE OF THE RESULTS of labor legislation has been the widening of the gap between management and the employees, but today a more powerful force is serving to close that gap. Whatever the strength of labor organization might be, men and women still look to their employers for direction when emergencies arise.

Today management must talk to its people and give them the encouragement they need to play their role in war. Not to help the company must they be urged to do their utmost, but to strengthen the supply lines to our armed forces. And on the personal side they must be encouraged to buy defense bonds and savings stamps, and to make their individual sacrifices cheerfully.

The responsibility for that patriotic education will be shared by others through carefully planned publicity of all kinds. There is one responsibility, however, that rests solely on management, and that is to keep their men fully sold on the essential character of their work. With utilities this is particularly true because a trained personnel is so necessary to maintain service continuity.

As the war progresses, men especially will have the feeling that they ought to take some part in its operations. They will feel like slackers if they do not. Everybody, however, cannot join the Army or the Navy. Back of the services must be production, and since all production depends upon electric power the men employed in making and distributing electricity ought to know just how important their work really is.

Some of these men will have to go because they will be needed in the field, and good management will be ready for that situation, when it comes, with trained replacements. This may entail longer hours in certain situations, but the men will not complain if they know the whys and the wherefores.

Management itself will have to work harder for the problems will be greater. The knowledge of these greater difficulties should be shared with the employees that they may understand that everybody is putting his shoulder to the wheel.

This, of course, is but one of the tasks that war imposes upon management. However, if properly handled, it may be instrumental in creating a better mutual appreciation and confidence between labor and management that will last long beyond this emergency.

Salvage Problems

WHEN there is a shortage of things it is commendable to conserve what we have and "make things do." Under present circumstances it becomes a matter of patriotism, a contribution to the survival of democracy. And that is why salvage programs, where they existed, have been intensified, and where they did not, have been instituted. In addition machinery has been set up to exchange surpluses. All this helps relieve the pressure on priorities. But the moves bring new problems entirely apart from the functioning under priorities.

These problems have the long-range element in them. They arise from calm contemplation rather than hectic decision to save everything possible, regardless. But finding the answer to them (there may not always be an answer) may be no less a patriotic contribution than a helter-skelter attic-filling parade of patched-up "it-will-do's."

Is it justifiable to apply a dollar's worth of salvaging labor and handling to save a one-dollar piece of material when a new piece, if needed, could be had for much less than two dollars without impeding national defense? The extra cost that will have been incurred will appear as a current operating outlay unless the circumstances warrant putting it down as a capital outlay for the job where the reclaimed material is used. Increment costs of this nature deserve consideration in a field of business where receipts, by the nature of things, may fail to keep comfortably ahead of the outgo.

Everything reclaimed in a wholesale program of save-all means keeping that much from getting back into the raw materials market via the junkman. With some products there might be more virtue in letting it recirculate in this way, provided there is reasonable assurance of availability in a refabricated form.

There must be a problem of stockrooming the reclaimed material. Are there bin provisions for almost-new goods or must these salvaged materials be mixed in with brand-new ones? How complex is the paper work that has to be devised to make the availability of reclaimed supplies known continuously to those, whatever their department, that can best fit them into current jobs? Would it not be wise to keep, also, a record of the places where reclaimed material was used so that the explanations will be forthcoming if early failures occur in critical places? Not everything can be rehabilitated so as to be

strictly as good as new goods bought to adequate specifications. It sounds sensible to know where substandard jobs were done in the emergency period so the jobs can be rebuilt when peace comes again.

Nothing said here need be construed as derogatory of well-conceived decisions to salvage this and that as power's help in a period of stringency in materials. While the salvage programs are emerging from a state of flux and taking sound patterns, there should be careful thought given, however, to unnecessary additions to the cost of doing business and to fruitless gestures of patriotism.

Current Thinking on the Smoke Control Problem

COMMUNITITES that may be disposed to be critical of smoke and fumes should know before they "start anything" that the problem is by no means being overlooked, because stack emission is getting active attention by many utilities. The fuels of nature, unfortunately, do not give up their valuable heat in combustion without occasioning smoke or palpable dust or fumes or, at the very best, carbon dioxide. Unfortunately, too, there is almost always air movement—ranging from zephyr to gale—that spreads the emission horizontally and prevents its rise vertically into the stratosphere.

What are the power-producing plants doing about these two manifestations of nature's perversity? Well, there are four things that can be mentioned: First, they have adopted combustion principles, equipment and controls which burn the fuel as completely as possible and thus prevent issuance of black, unburned carbon; the ash is largely trapped and removed at the point of combustion; second, the use of electrical and mechanical methods of catching or precipitating the particles that nevertheless passed through the furnace and boiler passages as these particles move toward the smokestack. The combination of just these two measures has done wonders toward reducing the visible smoke (as well as the invisible dusts) to the point where it is hard to tell from a distance which plants or which units in them are working to produce the wanted kilowatt-hours.

But that is not all. The physical heights of stacks, the contours of the power plant buildings and the prevailing winds are being studied to get the best results, particularly for new plants. The Baltimore utility even made adjustable small-scale models of its new Riverside plant, put them on a turntable in an aviation wind tunnel, blew artificial smoke up the miniature stacks, turned on the fans and took dozens of photographs. As a result they know how high the stacks must go, short of encroaching on the air lanes to an adjoining airport.

Finally, there is the perfection of techniques to identify the sources of the smoke and dust which reach any surrounding area. The deposits can virtually be fingerprinted. Such survey and analysis is in itself a worth-while contribution of the power industry because, beyond clearing the power-generating plant of blame, it shows the community just where to move in abating the nuisance from household, office building and industrial stacks.

Below Cost Rates Not Permitted to Regain Business Lost to MO

CAN A POWER COMPANY that has lost a greater part of its business in a community to a municipal operation primarily because of lower rates attempt to regain that business through still lower rates even though service at those rates be rendered at a loss? This very interesting question was decided a few weeks ago by the Tennessee Railroad and Public Utilities Commission against the Kentucky-Tennessee Light & Power Company with respect to rates for the city of Jellico.

There were a great many factors in the case to color the issue, such as: The city had had the highest rates in the state, the company resisted in the courts an order to reduce rates to a point higher than it now wishes to introduce on the grounds that they were confiscatory, the municipality had offered to purchase the company's facilities at a price to exceed its own cost for a new distribution sytem, the company's plant was old and in some respects obsolete, the company had lost all but 8 percent of its customers to the municipal operation. Executives of both the municipality and the company admitted the city was not large enough to support two competing utilities.

The commission insisted, and properly so, that its decision must be limited to operations over which it had jurisdiction in spite of the fact that the major portion of the company's business was in the adjoining state of Kentucky and from which the deficit, if any, would have to be made up.

Also, the commission recognized the propriety of non-compensatory rates in the development of new business. It might have gone farther and cited the holding of business threatened by competition from customer-owned power plant wherein rates have been allowed that carry a smaller rate of return than other classes of business.

The point, however, of the whole case seems to hinge on the very thing that utility companies have fought for for years, the right to do business under regulation without facing ruinous competition. Of late this contention has come as the result of threatened raids by municipal ownership. And now that the shoe is on the other foot, is not the argument equally valid?

The Tennessee commission, acting in a state that is avowedly pro-public ownership, had not only a legal matter to decide but one of public policy as well. In view of the facts as outlined in the commission's decision, we do not see how the commission could have held otherwise.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Import of the New York Transmission Line

ANY WAY you look at it, Senator Wagner's surprise announcement that President Roosevelt had approved a publicly owned and operated transmission line to bring power to the new aluminum plant at Massena, N. Y., is an attempt to set up a *fait accompli* by the public power trust. It serves also to re-emphasize that at least where means of promoting the St. Lawrence Waterway is involved the New Deal is overlooking no bets.

OPM — specifically its power branch—was studying this government scheme, as well as a plan for a privately built transmission line to carry surplus New York City energy to Massena, when Senator Wagner sprang the coup. Until recently, in fact, Jesse Jones' Defense Plant Corporation, which is putting up the money for the aluminum plant, had been negotiating with Consolidated Edison Co. for the privately built line. Despite a lot of local difficulties over location, it was understood that this deal was practically settled except for power price when the publicly owned and operated scheme was given a back door green light.

"Cogent Reasons"

At the President's request, Federal Power Commission reported favorably on the government-ownership plan, which was then shipped down to OPM with Roosevelt's instruction that it be given needed priorities unless "cogent reasons" were found for doing otherwise. It was while OPM was focusing on this development that the government operation scheme was unveiled publicly, with Presidential and FPC indorsements attached.

Up to that time it was an odds-on wager that OPM's report would have favored the privately built lines, with perhaps some government aid for part of the route, because it's cheaper, quicker and would take less scarce materials. All three of these counts represent to OPM "cogent reasons" for selecting one of two alternatives to follow in any given problem.

Important as this illustration is, as a New Deal by-pass of OPM to gain a public power objective, however, that isn't the whole import. Much deeper from the long-term view is the significance of this publicly owned and operated line as a big step in the direction of government supervised regional power pooling.

Separate Wholesale Supply

In a recent speech Chairman Leland Olds of FPC made this revealing statement:

"In these times we may recall that the efforts to assure adequate and dependable power supply during the last war bore fruit in the tremendous development of transmission during the succeeding decade, which produced our present power systems. And we may speculate on the possibility that experience in dealing with the power supply problems of the present emergency may lead to even wider coordination of wholesale power supply as a separate function, with the distribution end of the business separately organized on a more nearly local basis."

How would Mr. Olds bring this about?

The FPC chairman starts with the premise that there now exists vast possibilities for coordinating generating facilities over wide areas which have not been realized with present system setups. He considers it beyond question that the lines of demarcation between systems appear entirely artificial in terms of wholesale power supply, and even as obstacles to the best utilization of generating facilities.

From there, it is natural for him to call for more high-capacity intersystem connections, even for revamping of many present systems so as to obtain greater use from generating facilities. To accomplish this, Mr. Olds feels that government supervision is necessary, including government-supervised central load dispatching of regional pools.

A makeshift example might be the OPM-directed Southeastern pool now in operation. Mr. Olds, however, is thinking in terms of permanent setup, and of planned transmission networks fitted to full utilization of wholesale power potentialities.

Three Operations

Thus develops a picture of utility service split into three distinct operations:

Generation of energy for regional pools.

Regional government-directed central dispatching of wholesale energy to distribution outlets.

Local distribution of energy at retail on what amounts to little more than a "corner grocery" basis.

The scheduled public transmission line in New York is certainly intended to be a step in the direction of bringing such a program into being in that area, even as it now exists in the Tennessee Valley. The scheme calls for construction of the line by the Army Engineers, its operation by the New York State Authority. During the war period FPC is clothed with emergency authority to order utilities whose generating stations are tapped by the line to deliver the needed power.

Once the war is over, however, this authority could not be invoked to keep the line energized—but, in the meantime, the New Deal aims to see that the St. Lawrence project is built.

Government Financing

Mr. Olds doesn't tackle the financial side of this far-reaching realignment in the business of serving the nation the energy upon which its economy depends. He deals only with the operations phase of the metamorphosis.

It seems almost obvious, though, that the major source of capital for such an enterprise would have to be the government treasury. The record of New Deal envelopment of the electric power field wherever it has gone in is evidence enough of that.

All of which, in the minds of the New Deal's public power advocates, is a good thing.

NEWS OF THE WEEK

Pacific Coast Utilities on Emergency Schedules

Utility-controlled circuits operated effectively, but confusion marks customers' participation in blackout areas — Most companies inaugurate FPC plans for protection

Intensification of anti-sabotage measures and partial and complete blackouts of areas along the Pacific Coast followed immediately upon the Honolulu attack. Radio stations were on and off the air Monday night and Tuesday. Utilities met the emergency with greater dispatch than other agencies because of preparedness.

Two air raid warnings, one early Monday night and the second Tuesday morning in the San Francisco metropolitan area, were ineffectual and inadequate due to lack of warning and preparation. Street lights and other circuits controlled by the utility functioned according to schedule, but signs, store lights, buildings and residences, as well as floodlights of the two largest shipyards, blazed until well after the all-clear sounded.

20,000-Kw. Drop

Pacific Gas & Electric Co., which hit the all-time peak at 5.30 p.m. of 1,217,500 kw., dropped a maximum of 20,000 kw. from 6 to 8 p.m., when the first alarm was in force.

In Monterey Bay area the blackout was more effective due to preparation, except at Watsonville, where the utility pulled switches for 28 minutes. Most effective blackout on the whole coast was at Mare Island Navy Yard and Vallejo, where, on instructions of the Navy, Vallejo Electric Light & Power Co. opened all major switches.

In the Pacific Northwest, western Oregon and Washington blacked out at 11 p.m. Monday for the remainder of the night. This schedule will continue nightly on orders from the Army. Only one radio station, 50,000-watt KIRO at Seattle, will be on the air after 7 p.m. nightly in the area bounded by California and Canadian borders east to Boise.

No general blackouts occurred in the Los Angeles metropolitan area, but a local blackout took place at 4 a.m. Monday in the Los Angeles harbor district on orders from the Navy and continued Monday and Tuesday, with street lights only on during peak traffic hours. San Diego went dark at midnight Monday purely as a precautionary measure, according to the Navy. Radio stations were silent in southern California Monday night except for one minute out of each fifteen.

Most utilities immediately placed into full force FPC recommendations for plant protection. Reclamation Bureau placed additional guards at Grand Coulee. Army Guards took over at Boulder Dam and Long Beach steam plant. Typical of precautionary procedure was that of Los Angeles Bureau of Power and Light, where plans of an anti-subversive committee previously worked out with FBI cooperation were placed in full effect as follows: No visitors at any plant. Identification passes for all employees, Boulder transmission line guards expanded, 200 employees deputized and armed, 300 specially trained for emergency conditions. Other coast utilities functioned similarly, with occasional modifications to meet local conditions.

Following War Department orders received late afternoon December 8 Portland blacked out from 11 p.m. to 30 minutes after dawn. This was carried out more perfectly than the test blackout October 31. There was no disorder nor any major crime.

Electric load in the area started dropping off at about 10 p.m. and by 11 o'clock it was 77 percent of the previous Monday load and by midnight 53 percent.

Early in the week floodlights on the dome of the nation's Capitol were ordered turned off for the duration, and Washington street lights were dimmed, mainly to accustom pedestrians and motorists to travel over less brightly illuminated streets.

Some communities on Long Island, N. Y., had blackouts and the Consolidated Edison System of New York, serving the city and the suburbs, had crews ready on 24-hour service to repair any damage due to bombs or other causes.

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New England Systems Well Guarded

Outbreak of war Sunday with Japan found New England public utilities generally well protected against sabotage as a result of programs set up many months ago. Generating plants and substations have long been sharply restricted to visitors, only those known to company officials and having business on the premises being allowed to enter such property.

In Massachusetts companies of the State Guard were ordered by the military authorities to take up their posts at certain important electrical centers, supplementing the existing policing methods. Complete identification of utility employees has been required for some time in such plants. It is expected that in due course these troops will be replaced by other guards. The

From the supply sergeant, of course. He got it from the Ordnance Department—and they got it from a factory. It's the finest Army rifle in the world.

But before one factory wheel could turn—for the first model or the finished job—there had to be *power*—and most of it is *electric*. Electric power helped put your Garand in your hands, Johnny.

It takes a tremendous *lot* of power to make all the guns, tanks, planes and ships we need—but America *has* a lot. Power reserves, built up in advance by the business men who manage America's electric companies, have been able to meet almost every defense demand overnight.

Requirements keep increasing, of course—and the electric companies are working day and night to keep ahead of the nation's needs. In 1941, they built and installed almost 2,000,000 more horsepower in Democracy's busy arsenal!

You have the hardest part of the job, Johnny, but we're glad we can help by doing our share. We're glad to pledge our wholehearted co-operation with you, the government, and other industries—*to make America so strong it can remain forever free and unafraid.*

This page is sponsored by 80 local electric companies—all producing power for America under American business management.*

* NAMES ON REQUEST FROM THIS MAGAZINE

Invest in America! Buy Defense Bonds and Stamps.

TELLING THE PEOPLE—First advertisement in an initial series of thirteen telling the people of the utility industry's service in national defense, comfort, convenience and safety appears in the current issue of *Collier's*. The same advertisement will appear in successive weeks in *Life, Saturday Evening Post, Time* and *News Week*. It is expected that a radio program will supplement the series of advertisements

use of fencing, floodlighting and of electrical warning systems notifying operators of the approach of persons to utility properties has become more general, although some companies prefer to avoid spotlighting substations at night.

Transmission line patrols have been continued as before. Waterworks, gas plants, sewerage plants and other fixed points of utility importance have been given stiffer supervision since the outbreak of hostilities.

Generating plants are well prepared to provide additional service in most localities as the war program advances. If the use of the third shift develops, as seems probable, calling for heavy increases in energy supply to industries during the night hours, as well as to government plants, bases and other military areas, little difficulty should be encountered in meeting requirements by working existing apparatus harder through such off-peak periods.

It is expected that the armed services will absorb a relatively small number of utility employees in proportion to the total, in view of the vital nature of electrical service to the nation.

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Permits New Power Lines

Maine Public Utilities Commission has approved locations in South Portland for erection of two auxiliary power lines aggregating 110,000 volts. Chairman Frank E. Southard of the Maine Commission declared it is the purpose of the Cumberland County Power & Light Co., which will build the lines, to establish a set-up of lines that could be used to pull additional power from other sections of the state whenever an emergency arises.

War Seen Imposing Limits on Utilities

The actuality of war developed few immediate concrete pointers of "what's ahead now" for utilities this week. Obviously, formal war with Japan will bring new stringencies affecting utilities, as well as all industry and civilian life, but the first few days brought no marked change in guiding principles heretofore in effect.

Most significant perhaps is the apparent strengthening of OPM Power Coordinator J. A. Krug and his policies. Krug has been opposed, principally by Federal Power Commission, for letting the Navy take turbine and boiler manufacturing capacity booked or wanted by utilities. Now, with actual war, which must essentially be naval in early stages, this policy seems inescapable.

Of far-reaching significance was OPM's second major revision of the P-46 priority order (see page 97, this issue) but this cannot be traced to the advent of hostilities; it was being written before Japan attacked.

New Restrictions

The war will bring, inevitably, many additional restrictions on utility operations because of home defense activities, such as the blackout tests in many sections this week. Stepping up of the military production program and likely early increase in seven-day operations also will bring additions and shifts in operations and in loads. In the appliance field, the President's statement that at least 50 percent of metals which have been going into civilian commodities will now have to be diverted to war purposes augurs much heavier curtailment orders than those issued to date. SPAB expects to give early review to all civilian production programs now in effect, and to speed completion of other limitation orders.

FPC acted early in the week to insure that all anti-sabotage measures previously outlined in conferences were put into full effect at once.

At the Securities and Exchange Commission there appeared to be no disposition to relax the drive for compliance with the Holding Company Act "death sentence." No official comment was forthcoming, but unofficially it was plain that at least for the present there will be no shift from previously enunciated policies.

Rural Electrification Administration's applications and loans division—its promotion department—expects virtually to close up shop; its engineering staff has been placed at the disposal of any defense agency which can use its services.

SPAB Moves to Freeze Competitive Positions

Public projects and utility companies forbidden to use inventories to gain construction advantages — Duplication of facilities prohibited — Exempt extensions limited to 1,000 feet

The Supply Priorities and Allocations Board, top defense agency, has directed that far-reaching restrictions be placed on all utility construction and that "competitive" positions of public and private utilities be frozen. OPM, acting promptly with vital amendments to priorities order P-46, has moved to put the SPAB policy into full effect.

SPAB's formal statement of policy on power matters was issued as an explanation of its allocation of 1,500 tons of copper monthly for seven months (subject to review in three months) for completing projects now 40 percent or more built (ELECTRICAL WORLD, December 6, page 3). It directs:

No Discrimination

That public and private utilities be treated alike, and that possession of inventories "should not allow one group to undertake a project for which the other is denied priority assistance."

That neither public nor private utilities may initiate projects duplicating facilities of the other.

That private companies may not use inventories to preempt territory under development by REA.

That all proposed extensions, whether from inventories or not, be submitted to OPM in advance for approval, disapproval or modification.

OPM's revision of P-46 to implement this policy puts into immediate effect these new provisions:

Prohibits withdrawals of materials from inventories for new construction or extensions without prior OPM approval.

Exempts from the above restriction projects 40 percent or more complete on December 5 for which inventories are available or for which materials are made available through priorities.

Exempts also line extensions costing less than $500 overhead or $1,500 underground, which do not extend more than 1,000 feet from present facilities. The dollar figure was in effect previously, but the distance limit is new.

Blankets all utilities, whether or not they have adopted P-46 and are using its A-10 rating for repair and maintenance supplies, under the inventory and withdrawal limitations of the order.

Revises section F-3 to limit withdrawals from inventories for repairs, maintenance, operating supplies, "or for any purpose," in any quarterly period to the withdrawals, in terms of dollar value, in the comparable 1940 quarter or one-fourth the total 1940 withdrawals, at the utility's option.

Requires maintenance of continuing inventory by all utilities.

Both public and private utilities, including Rural Electrification Administration co-operatives, are specifically covered by all the terms of the revised order. It appears unlikely, however, that the policy will immediately affect construction by REA of transmission facilities in northern Texas to bring Possum Kingdom hydro power to distribution co-ops. But REA is reportedly ready to limit construction in that area to that necessary to put Possum Kingdom energy to use, abandoning plans for a duplicating transmission network designed to tie in with projected generating plants in other parts of the state.

SPAB's policy is not a "war policy" developed because of the outbreak of hostilities in the Pacific. In deciding to allocate copper to REA last week, before Japan's attack, SPAB stated that a formal comprehensive policy regarding utility construction would be forthcoming.

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Funds Approved for Utility Purchases

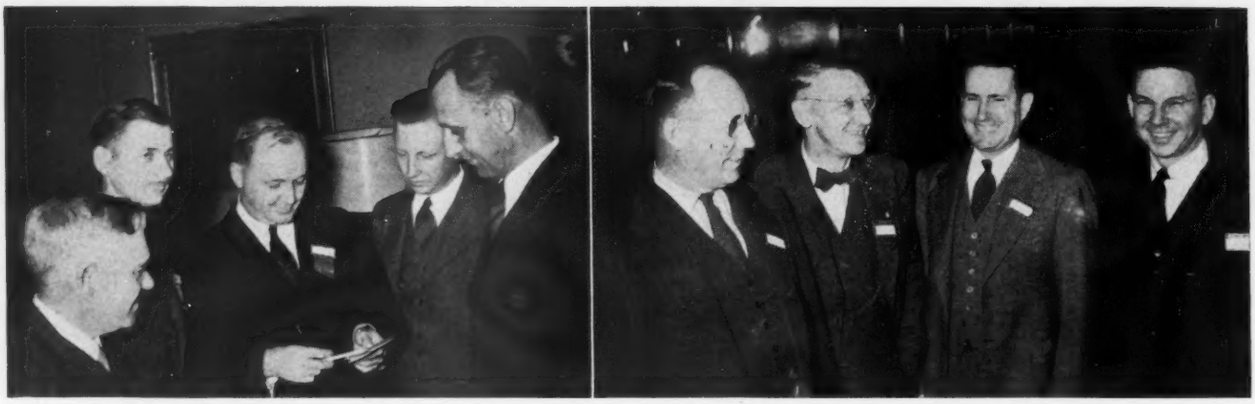
The Reconstruction Finance Corporation may loan up to $150,000,000 to private and public corporations for the acquisition of utility operating companies separated from affiliates by operation of the Holding Company Act, under terms of a bill passed last week by the House banking committee.

A revision in the bill provides, however, that such funds may not be utilized unless the RFC has found that the transaction cannot be financed through the aid of private capital.

Federal Loan Administrator Jesse Jones testified that a project typical of those embraced by the bill were the pending negotiations for sale of Puget Sound Power & Light Co., subsidiary of Engineers Public Service.

The SEC has ordered Engineers to dispose of its Puget Sound holdings within a year as a mandatory order under the Public Utility Holding Company Act.

A BOW TO THE LADIES—Among those honored last week in New York by the National Association of Manufacturers for an outstanding contribution to defense production were (left to right) Miss Vivien Kellems, president Kellems Manufacturing Co., New York, the only woman manufacturer of electrical equipment and whose products are used by the American and British armed forces; Dr. Hertha Freche, the only woman employed in the research department of the Aluminum Company of America and widely known for her experiments with aluminum formulas; Miss Catherine Ferguson of General Electric Co., one of the few women metallurgists in the U. S., and now exclusively engaged in defense work, and Mrs. Ruth Wallgren of the Westinghouse Electric & Manufacturing Co., engineering draftsman on electric turbines at the South Philadelphia works



WITH A.I.E.E. AT NEW ORLEANS—Among those attending Southern District A.I.E.E. sessions were (left to right) H. T. Fortner of Mississippi Power, F. E. Johnson of New Orleans Public Service, J. M. Todd, consulting engineer and chairman of general committee, A. J. Watson of Mississippi Power & Light, F. C. C. Brash of Mississippi Power, J. T. Logan of Georgia Power, A. C. Morrison of Duke Power, P. B. Boyd of Georgia and W. J. Fransinoli of Memphis Light, Gas & Water Division

A.I.E.E. Southern District Meets in New Orleans

Engineers discuss mercury-arc rectifiers, use of synchronous condensers to sustain frequency, underground network developments, eight power-line carrier characteristics

A wide range of technical subjects marked the three-day program that attracted nearly 400 electrical engineers to New Orleans for the southern district meeting of the American Institute of Electrical Engineers, December 3, 4 and 5. Ten technical papers dealing with matters ranging from automatic dimming of automobile headlights to parallel operation of load-ratio-control transformers were presented in the two technical sessions.

Arc Rectifiers

J. E. Housely, Aluminum Company of America, and H. Winograd, Allis-Chalmers, in a joint paper presented an exhaustive description of the Alcoa mercury-arc rectifier installation. In discussion Otto Jensen, I-T-E Circuit Breaker, reported that anode type circuit breakers—an outgrowth of work at Alcoa and having an operating speed of ¾ cycle—have successfully interrupted 287 backfires before contacts needed attention. In a recent test, he stated, anode breakers were subjected to 25 short circuits of 40,000 amp. at 625 volts at fifteen-second intervals. To the Alcoa installation, he stated, can be attributed credit not only for development of the anode breaker but also "excitron" and "ignitron" rectifiers.

Synchronous condensers when used with high-speed switching offer reliable means of preventing objectionable motor speed variations in voltage-sensitive manufacturing processes, such as are found in the silk and printing industries, J. L. Logan and John H. Miles, Georgia Power Co., reported. Kinetic energy in the rotor of such condensers is generally sufficient to supply load equal to its kva. rating for one second, before frequency falls to objectionable values.

Eventual developments in low-voltage underground networks, foreseen by P. B. Boyd, Georgia Power, include incorporation of the network protector as part of the transformer, discontinuance of the disconnect and grounding switch, use of non-leaded cable as standard construction, eventual replacement of fused junction boxes (even on leaded installations) with limiters, vault installation of permanent fixtures for use with portable fire-extinguishing equipment and wider use of network supervisory systems to catch incipient faults.

Wave Demonstrator

Using a mechanical "wave demonstrator," Dr. G. D. McCann, Westinghouse, showed the manner in which surges produced on transmission lines by direct and indirect lightning strokes are propagated along the line. By setting up mechanical equivalents of transformers and lightning arresters, he was able to show graphically the behavior of surges at points of discontinuity on the line.

As a result of experience with 8 power-line carrier telephone channels and carrier pilot relaying on 20 high-voltage transmission lines of the TVA system Messrs. M. S. Merritt and T. D. Talmadge of TVA have concluded: (1) that diversification of routes and types of communication gives maximum dependability, (2) such diversification should include power line telephone channels, (3) that interconnection of individual frequency carrier telephone channels is feasible for service extension over greater area, (4) general use of emergency power supply adds to reliability of carrier telephone service and (5) that periodic routinized inspection and maintenance is vital.

In an analysis of the operation of load-ratio control transformers connected in parallel and in networks, F. M. Starr, General Electric Co., established criteria for adjustment of compensators and contact making voltmeters used for this type of application.

R. A. Hopkins, TVA, described principal electrical design features of the ten hydro-electric stations designed and constructed or currently under construction by the Tennessee Valley Authority. The entire system steam and hydro when present construction is completed will have a capacity of 2,578,170 kw. in 107 units, it was stated.

•

Plants at Full Capacity

Power plants of the Ontario Hydro-Electric Power Commission at Niagara Falls now are operating at full capacity through the diversion of an additional water flow of 6,000 cu.ft. per second. Authorization for the additional diversion, bringing the total water flow to 50,000 cu.ft. per second, as compared with the 36,000 permitted under the original boundary treaty, became effective on November 27 "and is now being used," Dr. T. H. Hogg, chairman of the commission, announced.

Engineers Visit Montaup, See Boiler Construction

Inspect forced circulation boiler as features are described — Complete water circulation in one minute — Excluding fittings, 2,640 welds made in field

Montaup Electric Company's Somerset station, near Fall River, Mass., where the first large-scale installation in the world featuring the controlled forced-circulation boiler is under construction, was visited on December 5 by 161 engineers from the New York, New Jersey and New England areas as guests of Combustion Engineering Co., Inc., manufacturer of this advanced steam-generating equipment. The Montaup installation and engineering considerations back of its design were featured in an article by Frank S. Clark, consulting engineer, Stone & Webster Engineering Corp., Boston, in ELECTRICAL WORLD, August 23, 1941, page 52.

At the time of the engineers' visit last week the furnace was inclosed on three sides; Ingersoll-Rand controlled forced-circulation pumps were in place, and work on the superheater and other auxiliaries was well advanced. The foundation for the 25,000-kw. G.E., 1,825-psi. topping turbine with hydrogen-cooled, 14-kv. generator was ready to receive the machine, expected about December 15.

F. H. Rosencrants of the Combustion Engineering staff pointed out departures from previous practice, which, however, were based on long-tried principles and applications on a smaller scale abroad. In the boiler, he stated, there is 22.3 miles of tubing, of which 11.9 miles is in the furnace; the capacity of the boiler is 650,000 lb. per hour at 1,825 psi. at the superheater outlet, with a steam temperature of 960 deg. F., and the time for complete circulation of water in the system with two pumps operating is only one minute. Exclusive of fittings, 2,640 welds were made in the field.

It was pointed out that the positive and adequate circulation at all points permits the use of smaller diameter tubing and of lighter gauge than otherwise, resulting in a reduction of temperature gradient through the tube walls as well as a reduction in weight. The relationship of water velocity to tube diameter provides a high degree of turbulence, prohibiting the formation of steam film between the water and tube wall, and still further reducing the temperature gradient.

A flow of water substantially in excess of the amount being evaporated can be provided to assure wetted surfaces at all points where the gases are in contact with the tubes, and since the water enters each circuit through orifices and is free of steam at the point of admission, the flow to the various circuits can be closely predetermined. The rapidity with which the water circulates assures uniform distribution of feedwater chemicals and any sample taken can be regarded as representative of exact conditions at all points in the system.

Since Mr. Clark's article appeared, the purchase of a 35,000-kw., 70 percent power-factor, hydrogen-cooled G.E. turbine-generator has been announced to complete the topping set-up. Delivery of this machine is scheduled for 1944.

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Gets Advertising Award

First place award for the best public utility advertising in the United States during 1941 has been won by the Southern California Edison Co. The Socrates award for the year, the recognition annually accorded by *Public Utility Ad-Views* to the company with the best consistent advertising performance, was made to the Southern California company in point score competition with all classes of public service companies. A first place award previously was won by the Edison company in 1935, and last year the company was given third highest award.

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Toledo Dedicates 60,000-Kw. Turbine

Toledo Edison Co. on November 27 dedicated its new $4,500,000 turbine and started it in operation, boosting the maximum capacity of its Acme plant to 220,000 kw., assuring for the city ample power for all normal and defense needs. The new turbine, with maximum capacity of 60,000 kw., was dedicated by Carroll L. Proctor, president of Toledo Edison; W. Alton Jones, president of Cities Service Co., and R. E. Berger, president of Cities Service Power & Light Co. The official ceremony was preceded by a luncheon attended by nearly 100 civic leaders.

Mr. Jones, speaking at the luncheon, said he had recently completed a 14,000-mile trip about the country, and that it seemed significant that the only places in the country where power shortage is acute is in those places where the government has been most active. He said he couldn't blame the TVA, but that such development discouraged private investment, and "until we find some better way, I go the way of private investment."

He said these were trying times, and all efforts should be devoted to the good of the government.

SCENE AT MONTAUP—Upper left rear corner of furnace of controlled forced-circulation boiler, showing left side wall and front bank of boiler tubes

Wilson Calls for National Cooperation

Pointing to the tide of war and revolution that is sweeping over the world, Charles E. Wilson, president General Electric Company, in an address before the National Association of Manufacturers, meeting in New York last week, called for co-operation of leaders with leaders, leaders of management, of labor and of government, first, so that military aggression against this country will be halted and, secondly, so democracy will be made to work in order that, when the shooting has stopped, the nation will go on to fulfill its destiny.

"The task is so tremendous, so decisive of weal or woe for our nation, so fraught with destiny for all of us individually and collectively," Mr. Wilson declared, "that I cannot discuss it with slogans subject to various interpretations, or with well-worn historical allusions, or with criminations and recriminations about past or present misunderstandings."

Face Realities

"Let's wipe the slate and face the big realities. Others will if we don't, and we want to have a part in the future that is now in the making, such a part as the leadership that has been intrusted to us in our great field of productive enterprise justifies us in taking, if we will take it."

Industry should not "back into the future reluctantly, or be dragged into it," Mr. Wilson said, because its eyes are fastened on the past. Make it clear that industry is out to help make that future, he said, with a full sense of the social responsibilities and of the opportunities and obligations which are involved and of the challenge to private enterprise that industry is ready to meet.

Some parts of the job which must be done in America are logically within the province of government and others within the province of private enterprise, Mr. Wilson stated, and business men should take the initiative in defining the obligations the whole system can and will positively assume. Public-spirited leaders in finance, industry and commerce, he said, should establish the obligations of business and, having established these, "they should urge equally enlightened leaders in labor and agriculture to proceed to the same end." After all factors had reconciled their differences and reached an agreement upon their joint responsibilities, Mr. Wilson said that then government —the servant of all of the people— could have a clearer definition of the public service the free enterprise system could be relied upon to supply and in turn there would be a clear definition of the province in which government could operate in the common interest.

No thought of arm's-length cooperation was presented, Mr. Wilson concluded, but instead he sought "arm-in-arm concord and co-ordinated effort in the common good, the kind of concord and effort which can, in my judgment, eliminate the causes of conflict, competition and confusion between government and business."

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Southeastern Power Restrictions Lifted

The Office of Production Management has lifted all restrictions on the use of power in Southeastern States as a result of reservoir-filling rainstorms averaging one to three inches throughout the area.

Restrictions removed immediately included the blackout and the freezing of industrial power consumption to September levels. The heavy rains, the OPM said, greatly increased the available supply of hydro power.

OPM's order affected only the use of power and did not affect pooling or delivery of power into drought areas, principally Georgia, Alabama and Tennessee.

MEETINGS

Louisiana Engineering Society — Annual meeting, St. Charles Hotel, New Orleans, La., January 9-10. J. K. Mayer, secretary-treasurer, Suite 422, St. Charles Hotel, New Orleans, La.

Missouri Valley Electric Association—Power sales conference, Continental Hotel, Kansas City, Mo., January 15-16. L. D. Pettegrew, director, 1527 Sharp Building, Lincoln, Neb.

Canadian Electrical Association — Annual winter conference, Mount Royal Hotel, Montreal, Que., January 19-20; Western members, joint meeting with Northwest Electric Light & Power Assn., Business Development Section and Commercial Section, Vancouver, B. C., March 4-6. B. C. Fairchild, secretary, 804 Tramways Buildings, Montreal.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 26-30. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers—Annual meeting, Philadelphia, Pa., January 26-30. A. V. Hutchinson, secretary, 51 Madison Av., New York.

International Heating & Ventilating Exposition—Biennial exposition, Commercial Museum, Philadelphia, Pa., January 26-30.

Edison Electric Institute — Electrical equipment committee, William Penn Hotel, Pittsburgh, Pa., February 2-3; transmission and distribution committee, Hotel Cleveland, Cleveland, Ohio, February 9-11. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 9-12. A. H. Parsons, secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association — Mid winter meeting, Palmer House, Chicago, Ill., February 16-20. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

Lower Quotas Set for Refrigerators

Revising an earlier order, issued September 30, the Office of Production Management has ordered manufacturers of refrigerators to cut their production during January and February from 30 to 52 percent below the monthly average output for the twelve months ended June 30, 1941.

The previous order called for reduced output from August 1 to December 31 ranging from 29 to 45 percent, calculated on the same basis as above (ELECTRICAL WORLD, October 4, page 73).

Under the new order class A companies, whose average monthly sales (not their production) were 16,000 units or more during the base period, will cut their production 52 percent during January and February.

Class B firms, whose sales averaged from 5,000 to 16,000 per month during the base period, will cut production 40 percent below the base period levels and class C companies, with average sales of less than 5,000 per month, will be reduced 30 percent.

•

SPAB Decides on Copper Hearings

The Supply Priorities and Allocation Board, top defense agency, have moved to take the ball on conflicting rumors and charges regarding copper supplies and allocations.

With at least one, and possibly two, congressional inquiries into copper in the offing, SPAB directed OPM to hold an open hearing on the entire subject, from mine mouth to ashtrays, with particular emphasis on all proposals for stepping up production. Chester Davis, onetime agriculture member of the Old National Defense Advisory Commission and now chairman of the St. Louis Federal Reserve Bank Board, has been named by OPM to sit as impartial chairman over the hearings, beginning late this week.

SPAB two months ago ordered OPM to take all steps to increase domestic copper production, but it is known that many defense officials have been unsatisfied with results. With the recent drastic OPM priorities division order banning use of copper to many civilian products, effective next month, small businesses have been bombarding Congress with complaints that defense agencies are ruining industry unnecessarily.

Bureau of Mines data indicates that domestic copper production has been running about 80,000 tons (copper content) of ore monthly this year.

All-time High Level Reached in Output

The amount of electrical energy distributed by the electric light and power industry for the week ended Saturday, December 6, was 3,368,870,000 kw.-hr., according to the Edison Electric Institute, and thereby a new all-time record in output of kilowatt-hours was established.

The next two weeks will probably witness further record-breaking output figures.

Output for the week was up 13.2 percent over a year ago compared to the increase of 12.3 percent a week ago. The increases in the geographic divisions were spotty, ranging from an 18.7 percent gain in the Rocky Mountain area to a 9.8 percent gain in the Pacific Coast section.

The effect of the Japanese attack will not appear until this week's figures become available.

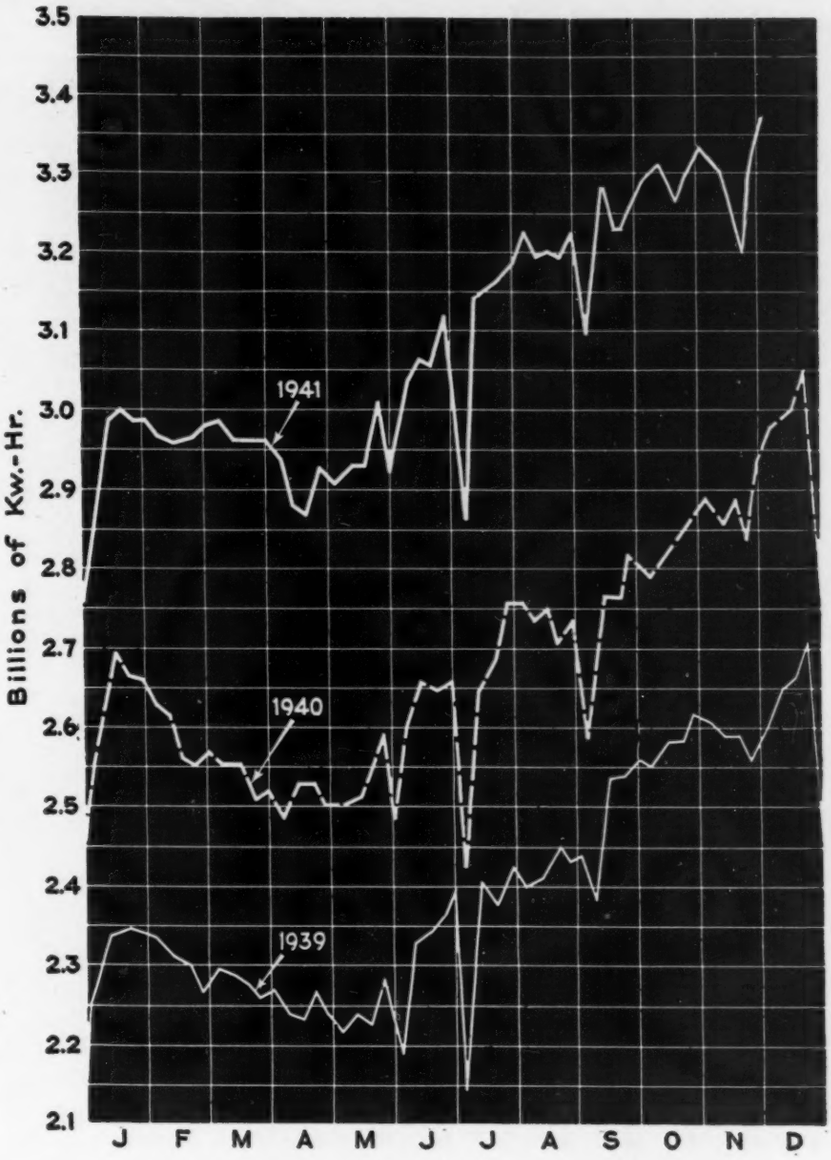
Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Dec. 6	3,369	Dec. 7	2,976	Dec. 9	2,654
Nov. 29	3,293	Nov. 30	2,932	Dec. 2	2,605
Nov. 22	3,205	Nov. 23	2,839	Nov. 25	2,561
Nov. 15	3,304	Nov. 16	2,890	Nov. 18	2,587
Nov. 8	3,325	Nov. 9	2,858	Nov. 11	2,589
Nov. 1	3,338	Nov. 2	2,882	Nov. 4	2,608

Percent Change from Previous Year

	Week Ending		
	Dec. 6	Nov. 29	Nov. 22
New England	+18.2	+23.2	+ 9.5
Mid-Atlantic	+10.6	+ 9.9	+11.2
Central Industrial	+14.3	+13.2	+14.5
West Central	+11.9	+12.8	+14.8
Southern States	+13.8	+ 9.3	+13.0
Rocky Mountain	+18.7	+16.3	+17.4
Pacific Coast	*+ 9.8	*+12.2	*+10.5
Total United States	+13.2	+12.3	+12.9

*Percentage should be higher — data under revision.



Army to Survey for New York Power Line

OPM has publicly recommended that Army Engineers begin detailed surveys and preliminary engineering for a government-built-and-owned high-capacity transmission line between Taylorville and Massena, N. Y., and to start general surveys for a possible line between Taylorville and New York City.

Although the OPM statement, in the form of a letter from Director General Knudsen to Under Secretary of War Patterson, appears carefully worded, it is now likely the defense agency will accept the plan to construct the entire line for government operation as proposed last week by President Roosevelt and public power advocates (ELECTRICAL WORLD, December 6, page 4). This means rejection of the proposed privately constructed line, which would be cheaper and quicker. The President has provided $300,000 of PWA money for an aerial survey by the Army of the route from New York to Massena.

While the government line probably cannot be finished in time to provide energy for the new aluminum plant being built at Massena, it is understood that temporary emergency power pooling and possible civilian consumption curtailment could be invoked for the interim.

•

Output Hits New High

Output of central electric stations in Canada in October amounted to 3,140,317,000 kw.-hr., a new high record, as compared with 2,866,647,000 kw.-hr. in September and 2,487,465,000 kw.-hr. in October last year. Total output during the ten months ended October was 27,040,578,000 kw.-hr., compared with 24,971,047,000 kw.-hr. in the similar period of 1940.

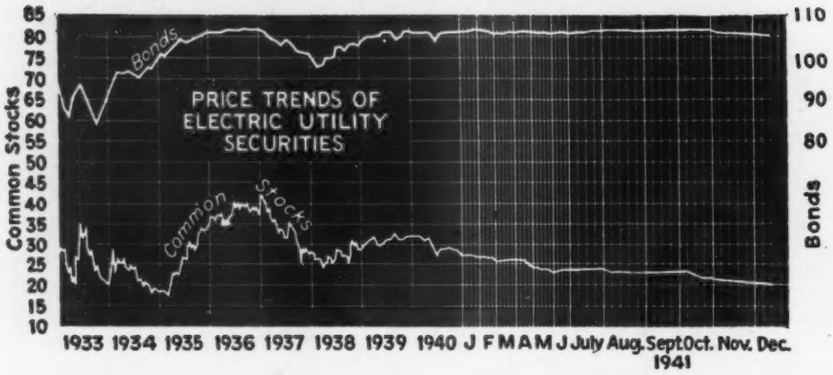
•

Material Shortages Curtail Meter Conversion Practice

Shortage of materials has necessitated sharp curtailment by Jersey Central Power & Light Co. in changing over existing indoor meter installations to outdoor jobs. Present stocks are being held in reserve for new installations.

Previously, indoor-type meters were converted for outdoor use at the rate of 5,000 a year in order to move the large stock of indoor types. The practice of changing meter installations to outdoor is about completed and at the present time very few meters are being converted to the socket type.

Stock and Bond Prices Turn Downward


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 J F M A M J July Aug. Sept Oct. Nov. Dec.
1941

Following the general market trend, utility securities lost ground during the last week. "Electrical World" stock index dropped to 19.5 from 20.4 the previous week; last year, 26.7. Bonds dropped to 105 from 105.7 the previous week; last year, 106.1. These are the lowest points for the year

Program is Filed by Electric Power

A comprehensive plan of recapitalization and physical integration designed to meet the requirements of the Public Utility Holding Company Act has been filed with the SEC by the Electric Power & Light Corp., a subholding unit in the Electric Bond & Share Company system. The essential proposals in the plan are:

Replacement of the existing preferred, second preferred and common stocks of Electric Power by a single class of capital stock, with each share having identical rights as to dividends, other distributions and voting power.

Retention by the corporation of a southern electric system as its principal integrated system and also of its United Gas Corp. system either as a part of the principal system or as a second system.

Disposal of the Idaho Power Co., Utah Power & Light Co., Dallas Power & Light Co. and Dallas Railway & Terminal Co.

The southern systems which the company proposes to retain consists of the Louisiana Power & Light Co., Mississippi Power & Light Co., Arkansas Power & Light and New Orleans Public Service, Inc.

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Nebraska Unit Sold by Utility System

Engineers Public Service Co. has signed a contract to sell the Nebraska properties of its subsidiary, Western Public Service Co. to Consumers Public Power District in that state for $6,575,000, D. C. Barnes, president, has announced. The company will use the net proceeds, after paying off Western's bonds and publicly held preferred stock, to buy 35,000 of Engineers preferred by tenders or on the New York Stock Exchange.

Providing that the SEC approves, the transaction is scheduled to be closed January 15, 1942. This will mean that with the exception of Omaha and its environs, the entire state of Nebraska will be served by publicly owned electric companies.

•

Pacific Gas & Electric Appeals SEC Decision

Review of the SEC decision holding that Pacific Gas & Electric Co. should register as a subsidiary of North American Co. has been asked of the Ninth U. S. Circuit Court of Appeals in San Francisco. Company attorneys held the SEC September ruling to be "arbritrary" and not in accordance with the evidence, pointing to the findings of a trial examiner in the case that P.G.&E. is not and never has been controlled by North American. Lack of personal contact and communications between the two companies was cited as further proof of local autonomy.

SEC counsel emphasized the "latent power" in the 17.71 per cent holding of voting stock of North American in influencing P.G.&E. policies. This percentage has since been reduced by the issuance of 400,000 additional shares of P.G.&E. 5 percent preferred.

•

No Action on Dividend

Alfred H. Schoellkopf, president of Niagara Hudson Power Corp., has stated that the board of directors at its recent meeting took no action regarding payment of a dividend on the common stock for 1941. Mr. Schoellkopf said that this decision was occasioned by the uncertainties of the future due to the war situation.

•

Union Electric Board Elects New Officers

J. Wesley McAfee, St. Louis attorney and former Circuit Judge, was elected president of Union Electric Co. of Missouri at a meeting of the board of directors on December 6. Dr. William McClellan, who went to St. Louis in 1939, as president, has relinquished that position and was elected chairman of the board.

Ralph E. Moody, for 25 years an operating executive of utility companies in Wisconsin, has been elected as vice-president in charge of operations and John A. Woodbridge, vice-president in charge of corporate affairs of Union Electric, was elected as vice-president and general counsel. Edward T. Gushee, executive vice-president, has resigned.

•

Forged Records Alleged in Associated Hearing

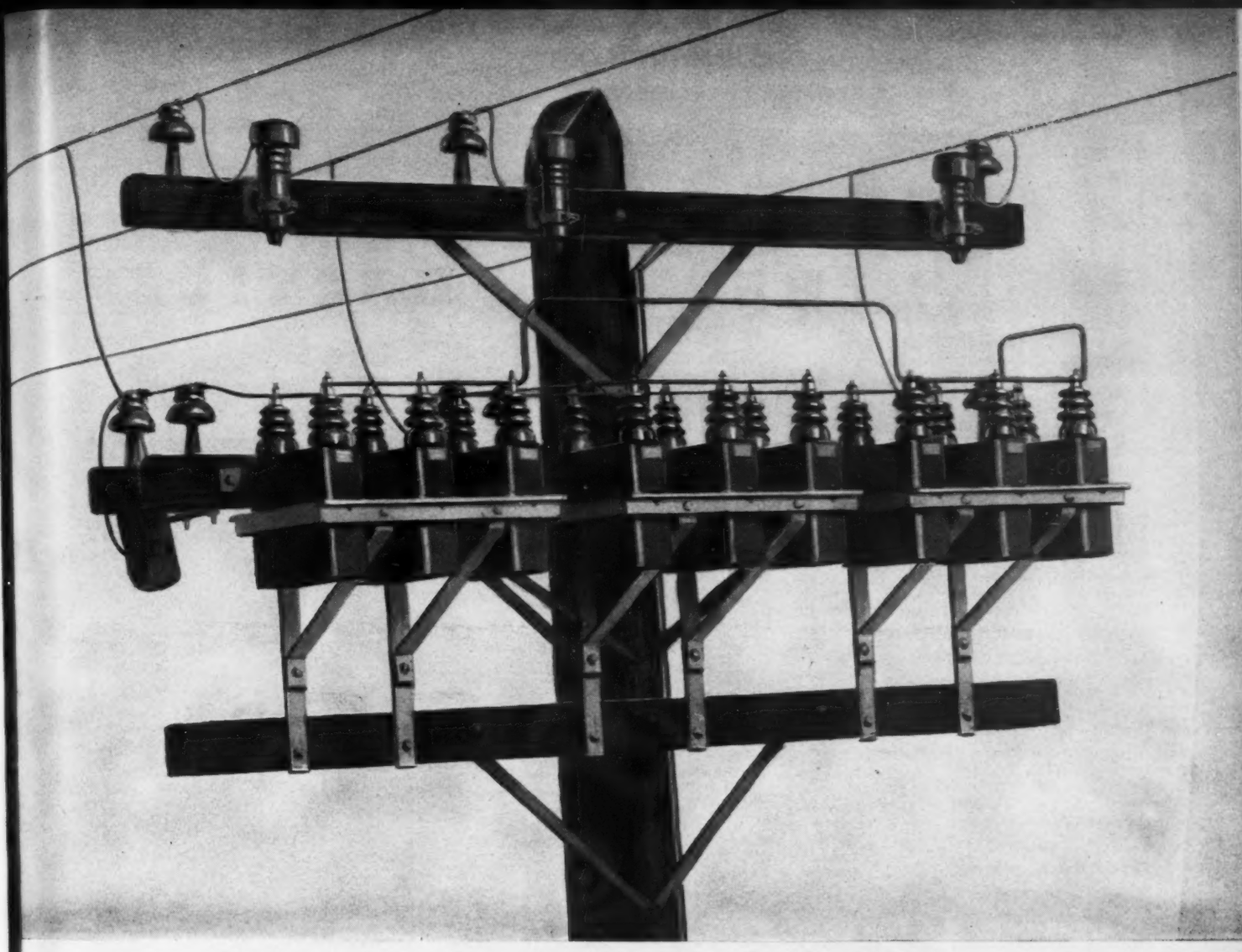
Albert D. Osborn, handwriting expert, testified before Frederick E. Crane, special master in federal court hearings on the validity of Associated's "Recap Plan" of 1933, that corporate records purportedly written in 1927 and 1928 were not written before late 1931. Mr. Osborn stated that the pages had been inserted in the records, and the dates of the latter had been altered.

The records referred to were part of the files of Associated Utilities Investing Corp. and Associated Properties, Inc., two former subsidiaries which were placed with the Associated Gas & Electric Corp. under the 1933 plan.

Utility Reports

	Net Income 1941	1940
*American & Foreign Power and subs.	$5,706,812	$4,786,477
*American Power & Light and subs.	9,833,617	12,559,021
†Carolina Power & Light	3,208,536	3,588,879
†Dallas Power & Light	2,022,427	1,895,944
†Florida Power & Light	2,658,515	2,396,381
†Houston Lighting & Pwr.	3,024,965	2,910,443
†Montana Power and subs.	3,585,097	4,164,948
*National Pwr. & Lt. and subs.	8,210,050	8,895,898
†Pennsylvania Pwr. & Lt.	7,632,298	8,818,549
*Standard Gas & El. and subs.	3,645,832	3,926,002
†Utah Power & Light and subs.	1,907,613	1,916,019
†Washington Water Pwr. and subs.	1,870,291	2,908,726

*Twelve months ended September 30.
†Twelve months ended October 31.



How G-E Capacitors Released 1200 Kva for Industrial Production

Cost of capacitors, $9,000; value of capacity, $60,000

BY IMPROVING power-factor with G-E Pyranol* capacitors, a Massachusetts utility gained 1200 kva of capacity from existing equipment. The capacitors cost about $9,000. The substation, transmission, and distribution facilities released represent an investment of $60,000.

A small expenditure for capacitors—it cost this Massachusetts company only about $7.50 per kva—may forestall for you the purchase of expensive equipment. For each kva of capacitors installed, from 0.3 to 0.6 kva of system capacity is freed.

If you need more capacity in a hurry, investigate G-E Pyranol capacitors—installation is simple and quick. It's merely a matter of banking standard 15-kva units at the desired location.

Call your G-E representative now. He'll be glad to tell you if Pyranol capacitors can provide the most profitable solution of your expansion problems. Ask for Catalog GEA-3333. General Electric, Schenectady, N. Y.

*Reg. Trade Mark.

GENERAL ELECTRIC

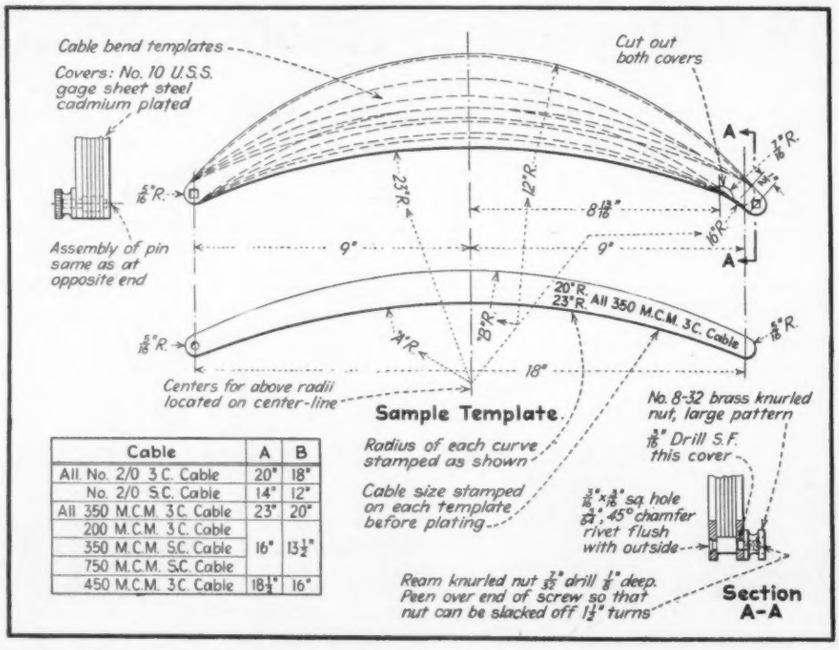
407-24-5700

OPERATING PRACTICES

Templates Guide Cable Training

To guide the training of cables in manholes, underground crews of the Detroit Edison Company use a set of sheet metal templates, each of which is cut to conform with the shortest allowable inside and the shortest allowable outside radius of curvature to which a given size of cable can be bent.

The seven templates in the set cover a range of cable sizes from No. 2/0 three-conductor up to 750,000-cir.mil single-conductor. Each of the templates is made of No. 16 gage sheet steel, cadmium plated, and is stamped with the radius of each of its two curves and the size of cable to which they apply. All templates are assembled on a pin and within a sheath made from No. 10 gage sheet metal, which is also cadmium plated. Details for building such a set of templates are given in the accompanying illustration.


Cable bend templates
Covers: No. 10 U.S.S. gage sheet steel cadmium plated
Assembly of pin same as at opposite end
Cut out both covers
Centers for above radii located on center-line
Sample Template
Radius of each curve stamped as shown
Cable size stamped on each template before plating
20°R. 23°R. All 350 M.C.M. 3C. Cable
No. 8-32 brass knurled nut, large pattern
Drill S.F. this cover
Ream knurled nut ... drill ... deep. Peen over end of screw so that nut can be slacked off ... turns
Section A-A

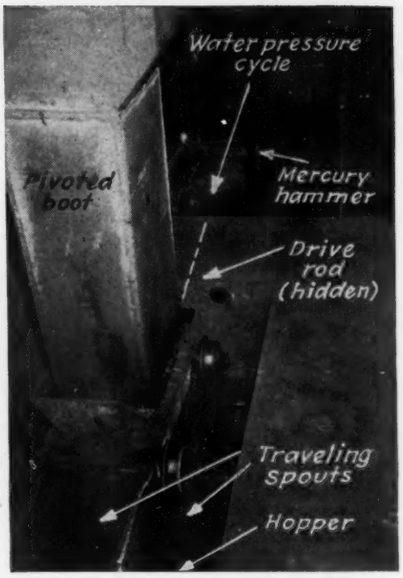
Cable	A	B
All No. 2/0 3 C. Cable	20°	18°
No. 2/0 S.C. Cable	14°	12°
All 350 M.C.M. 3 C. Cable	23°	20°
200 M.C.M. 3 C. Cable	16°	13½°
350 M.C.M. S.C. Cable		
750 M.C.M. S.C. Cable		
450 M.C.M. 3 C. Cable	18¼°	16°

SHEET METAL TEMPLATES determine minimum radii of curvature to which cables can be bent in training

Traveling Coal Spouts Solve Stoker Problem

Until they adopted their present continuous feed system for transferring coal from overhead bunkers to the hoppers serving chain grate stokers, engineers at the Omaha plant of Nebraska Power Company encountered a number of boiler operating troubles. Principal difficulties were traceable to packing, sliding and segregation of coal in the stoker hopper.

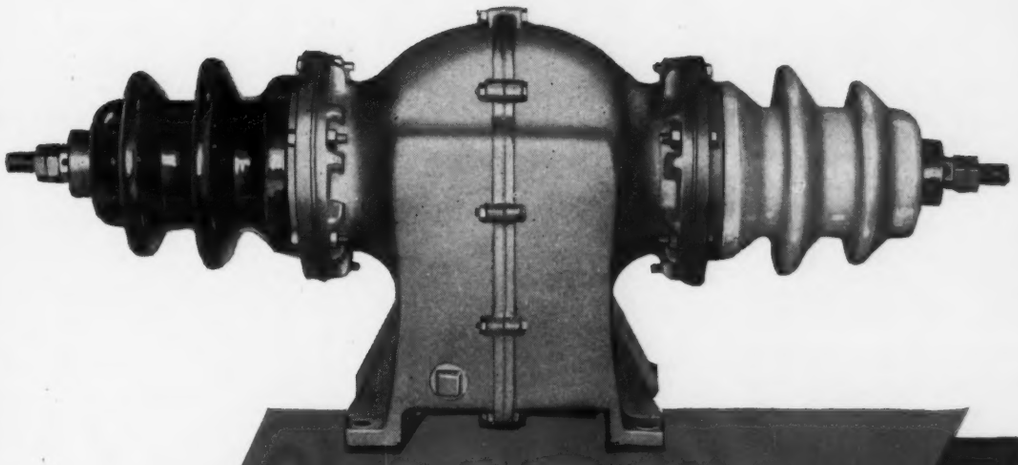
Packing of the moist coal in the hopper, followed by sliding, resulted in uneven distribution on the grate, with the inevitable development of blowholes in thin portions of the bed and the carry-over of coke in other portions. With the coning of coal in the hopper, segregation occurred with larger coal lumps running to the outside and again giving an uneven bed on the grate.



UNIFORM coal distribution in stoker hopper eliminates trouble due to packing, sliding and segregation

Solution to the problem was to carry a lower "head" of coal in the hopper—instead of filling the hopper—and by distributing the coal evenly across the hopper eliminate coning and segregation. With only a 12-in. "head" of coal in the hopper above the grate weight would not be sufficient to cause packing trouble.

Accordingly, the four stationary coal spouts from the two coal bunkers were each arranged to deliver coal by gravity through a pivoted boot to a reciprocity carriage, from the bottom of which three spouts fanned out



NOW POWER-LEVEL INSULATION IN A 15-KV C.T.

THIS G-E outdoor current transformer, Type JK-12, is adequately insulated—it passes the 110-kv, full-wave impulse-test requirement.

FOR BOTH METERING AND RELAYING

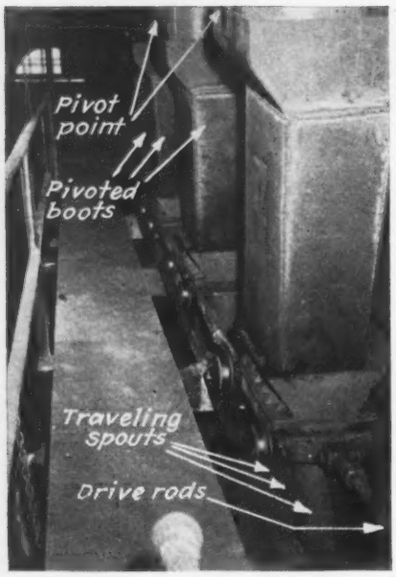
The 5- to 800-amp ratings of the Type JK-12 meet the highest-accuracy classification, $\frac{1}{4}$X, $\frac{1}{4}$Y, and $\frac{1}{4}$Z; the 1000- and 1200-amp ratings meet the $\frac{1}{4}$X, $\frac{1}{4}$Y, and $\frac{1}{2}$Z classification. Its characteristics during overcurrent conditions make it particularly well suited for relaying as well as for metering. General Electric, Schenectady, N. Y.

CONSTRUCTION

Mounting—either vertical or horizontal • Case—aluminum (rustproof and requires no paint) • Compound filling—high dielectric strength • Primary bushing—undercut skirts provide great creepage distance • Primary terminals—threaded-stud type • Secondary terminals—fixed studs in a compartment with conduit connections

GENERAL ELECTRIC

604-5-6400



STATIONARY SPOUTS from overhead bunkers deliver coal by gravity through pivoted boot to traveling carriages, each supporting three spouts extending into stoker hopper to within 1 ft. of grate

and down into the stoker hopper to within a foot of the grate. These carriages are mounted on tracks and are driven by a double-acting water-pressure cylinder. Travel of each carriage is 24 in. Speed is dependent on stoker speed. At a stoker speed of 45 ft. per hour carriages travel about 1 ft. per minute.

Reciprocating motion of the twelve traveling spouts (four carriages with three spouts each) distributes 1 ft. of coal uniformly across the hopper above the chain grate, which normally carries a 5-in. gate. There is no opportunity for coning and the coal thickness is too thin to pack. Experience with this arrangement has been entirely satsifactory.

The 24x10-in. water-pressure cylinder is operated by a three-way valve tripped from one position to the other by a mercury hammer mechanism.

•

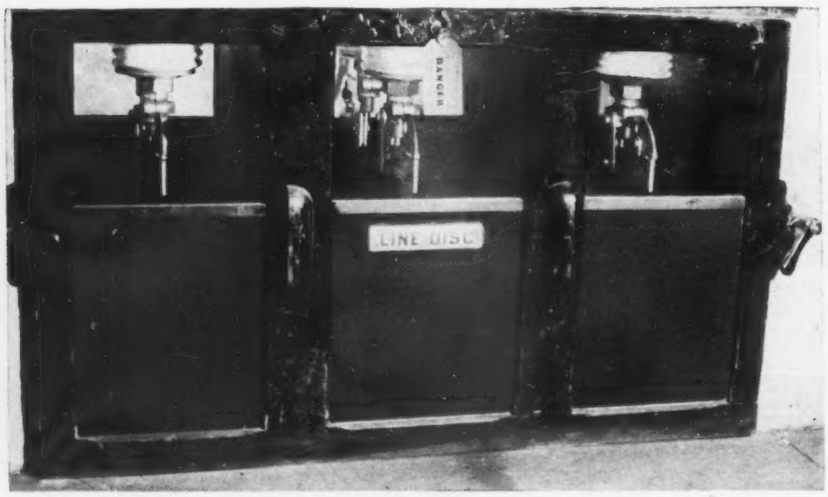
Glass Door Section Prevents Accidents

By R. M. SEITZ
Operating Engineer
Cincinnati Gas & Electric Company,
Cincinnati, Ohio

In supplement to "1.3 Million Man-Hours of Safety," by H. R. Kurth of Boston Edison Company, in ELECTRICAL WORLD, December 14, 1940, attention is called to a preventive method of avoiding accidents that is practiced by the Cincinnati Gas & Electric Company. This consists of installing a glass section in the doors of the sub-cell disconnects on "H" type breakers to facilitate the checking of clearances by maintenance men and operators.

Glass used is tempered plate glass (Herculite), which is four to seven times as strong as ordinary plate glass. It is held in place in the half section by a plastic "H" section of molding. Metallic molding and wire glass were not used because of proximity to the disconnects. Cellulose acetate or so-called safety glass were not used because of unstable properties over a period of time.

The accompanying illustration shows the disconnects in the open position with a sub-danger tag. Master danger tag is placed on the control of the oil circuit breaker at the switchboard and carries the serial number of the sub-tag.

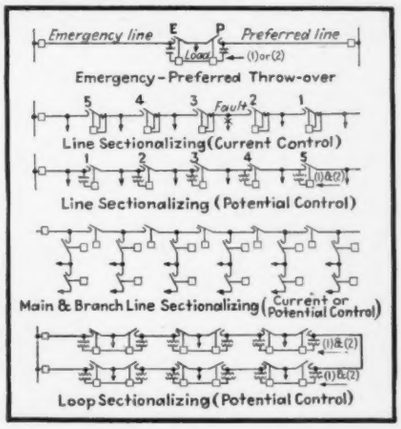


TEMPERED GLASS section in sub-cell disconnect compartments makes it easy and safe to check clearances

Automatic Outdoor Horn-Gap Switching

By O. A. HUNTSMAN
Switchgear Division, General Electric Company,
Philadelphia, Pa.

Horn-gap switches provide an economical method of improving continuity of service by automatically transferring the load from one source of power to another or of automatically isolating a faulty section of line. The operation of the switches may be co-ordinated with that of the power circuit breakers controlling the source



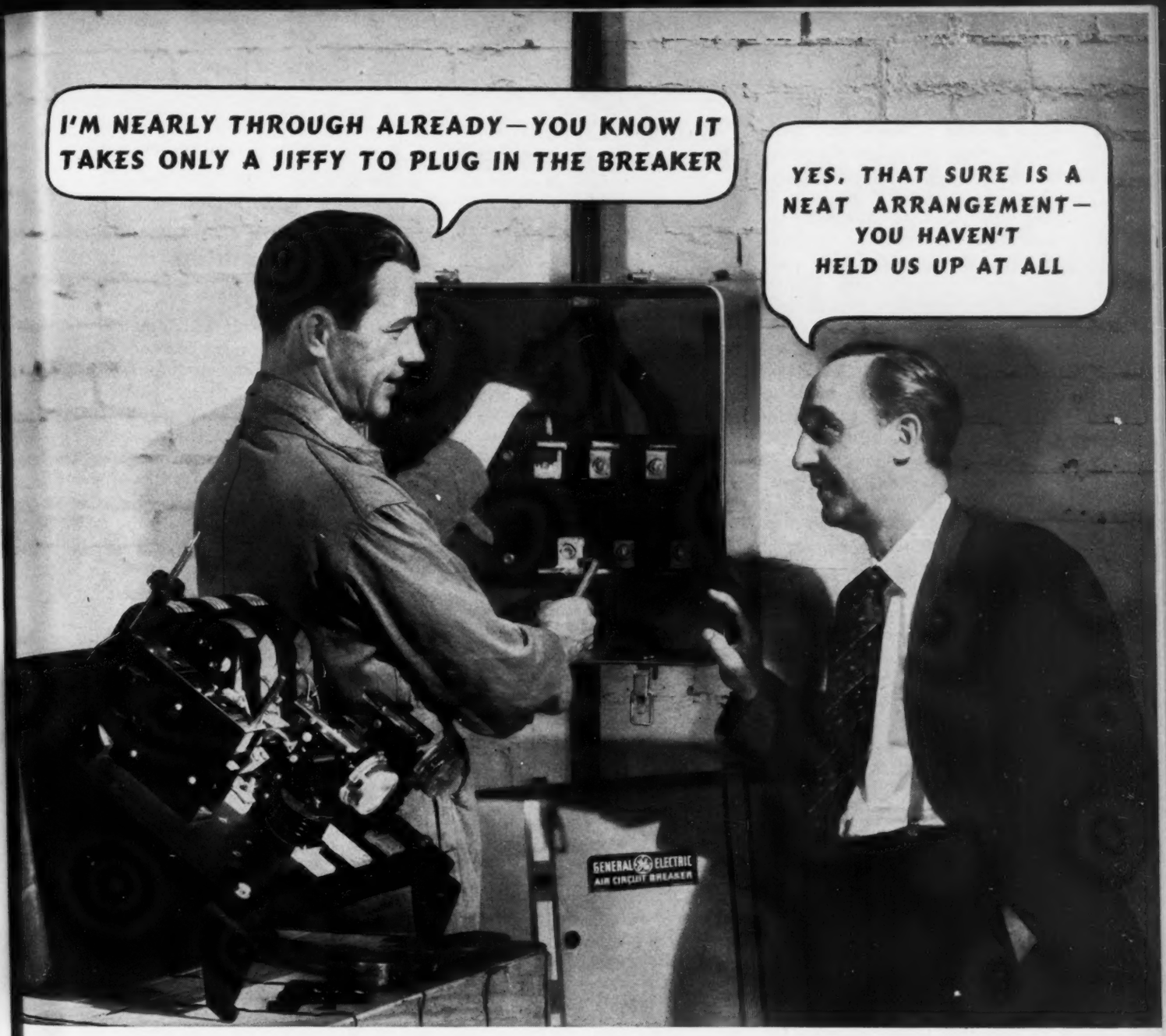
TYPES of switching with spring-operated mechanism (1) and motor-operated mechanism (2)
The motor-operated mechanism may be operated from a potential transformer when the line is energized, or from a separate source of a.c. or d.c. power. The spring-operated mechanism, with manual or motor-reset, stores energy for operating the switch and thus does not require an external source of power during operation, except for tripping energy, which may be supplied by a dry cell battery.

of power by undervoltage relays, current relays, time relays, direct electrical interlocking or a combination thereof. By proper coordination with the breakers the horn gap switches are not required to interrupt either load or fault currents.

Automatic throwover from a preferred line on which power has failed to an emergency line on which power is available can be accomplished by operating horn-gap switches with either spring-operated manual-reset or motor-operated mechanisms.

If the two sources of power are not synchronous the load must be removed while switching back to the preferred line, unless a means of synchronizing is provided.

In the case of line sectionalizing there are two methods of operation by


I'M NEARLY THROUGH ALREADY—YOU KNOW IT TAKES ONLY A JIFFY TO PLUG IN THE BREAKER
YES, THAT SURE IS A NEAT ARRANGEMENT—YOU HAVEN'T HELD US UP AT ALL
GENERAL ELECTRIC
AIR CIRCUIT BREAKER

Here's Why This New Removable Breaker Is So Easy to Install

HERE'S a breaker that sets a new record for quick installation. With the case bolted in place, it's easy to connect the cables—there's plenty of room to work. And then it takes but a moment to plug in the breaker unit, which has contacts that readily engage those in the case.

This new removable breaker saves valuable time when in service, too. In fact, it's called the *3-minute breaker*, because, with it, you can re-establish service after temporary faults in less than one minute; inspect the breaker in safety—away from live parts—in less than *two* minutes; and where load conditions have changed, you can interchange breaker units in less than *three* minutes.

Install these new AE-1 breaker units in lighting, power, and motor circuits. They will protect both the circuit wiring and the apparatus connected to the circuit. They will guard against the prolonged delays and the damage often caused when less adequate protective devices are subjected to severe short circuits.

A new illustrated booklet (GEA-3600) tells how and shows where to use these breakers. For a copy, write the G-E office near you, or address *General Electric Co., Schenectady, N. Y.*

THE BREAKER WITH THE DISCONNECT FEATURE

GENERAL ELECTRIC

860-24-7500

which a faulty section of line can be isolated. One method is to use spring-operated manual-reset mechanisms which are tripped by means of sequence relays, operated from current transformers in the line. The opening of the breaker, after each reclosure on a fault, operates the relays to open progressively the switches one at a time, starting with the switch farthest from the source, until the faulty section is isolated. This method of sectionalizing has economical advantage, but may require a large number of breaker operations.

Automatic Operation

The other method of line-sectionalizing is to operate the switches by means of voltage and time relays, with the following sequence of operation. When a fault occurs on the line the line-source power breaker opens and de-energizes the line. After the line has been de-energized for a definite time interval all the switches open, and after a second time delay the line breaker recloses, restoring power to the line up to the first sectionalizing switch. After an additional time delay the first sectionalizing switch closes and energizes the line up to the second sectionalizing switch. This continues until a sectionalizing switch closes in on the faulty section of the line. When this happens the breaker immediately opens and the last sectionalizing switch to close promptly opens and locks out. The breaker then recloses and restores power up to the locked-out switch before the other sectionalizing switches have had time to open. This type of sectionalizing requires both a spring- and a motor-operated mechanism, unless a separate source of power (other than a dry-cell battery) is available for operating the motor mechanism when the line is de-energized.

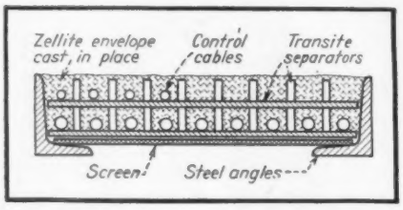
Operation of automatic horn-gap switching for main and branch line sectionalizing is the same as that for line sectionalizing except that the switching is extended to the branch feeders.

Operation of automatic horn-gap switching for loop-sectionalizing is basically the same as that for line sectionalizing except that the line is energized from both ends, and thus each feeder can be energized from two sources. This makes it possible to isolate a faulty section of line and still maintain power on all feeders.

"Zellite" Envelope Protects Control Cables

Cables controlling station auxiliary equipment at the Des Moines plant of the Iowa Power & Light Company, originally in open trays, have been cast in a "Zellite" envelope as a protection against mechanical damage and the effects of heat, fire or explosion.

When the plant was built auxiliary



TRAY-SUSPENDED auxiliary control cables cast in Zellite as fire and explosion protection

control cables from auxiliary control board to equipment was laid in open trays built from angle iron and heavy steel screen. These trays were suspended from the ceiling in various parts of the plant by rods. It was felt that in open troughs the cables were unduly exposed to damage of a number of types and practically impossible to keep clean.

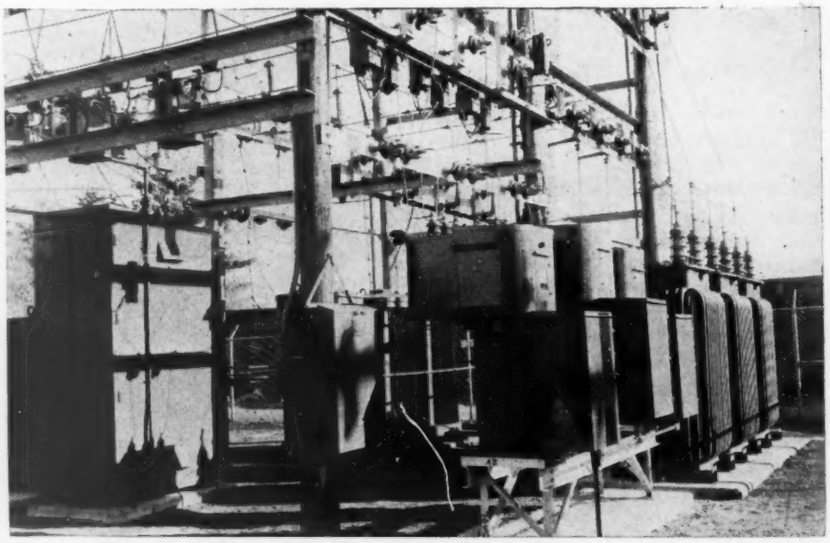
To guard against this, cables in each tray were separated into layers and each cable (ranging from four to ten conductors each) was isolated from each other by horizontal and vertical "Transite" barriers. Zellite, mixed with water to form a thick paste, was poured around the cables and allowed to dry, forming a hard concrete-like envelope that provided an effective protection against both fire and mechanical damage.

•

Indoor Regulators Used Outdoors

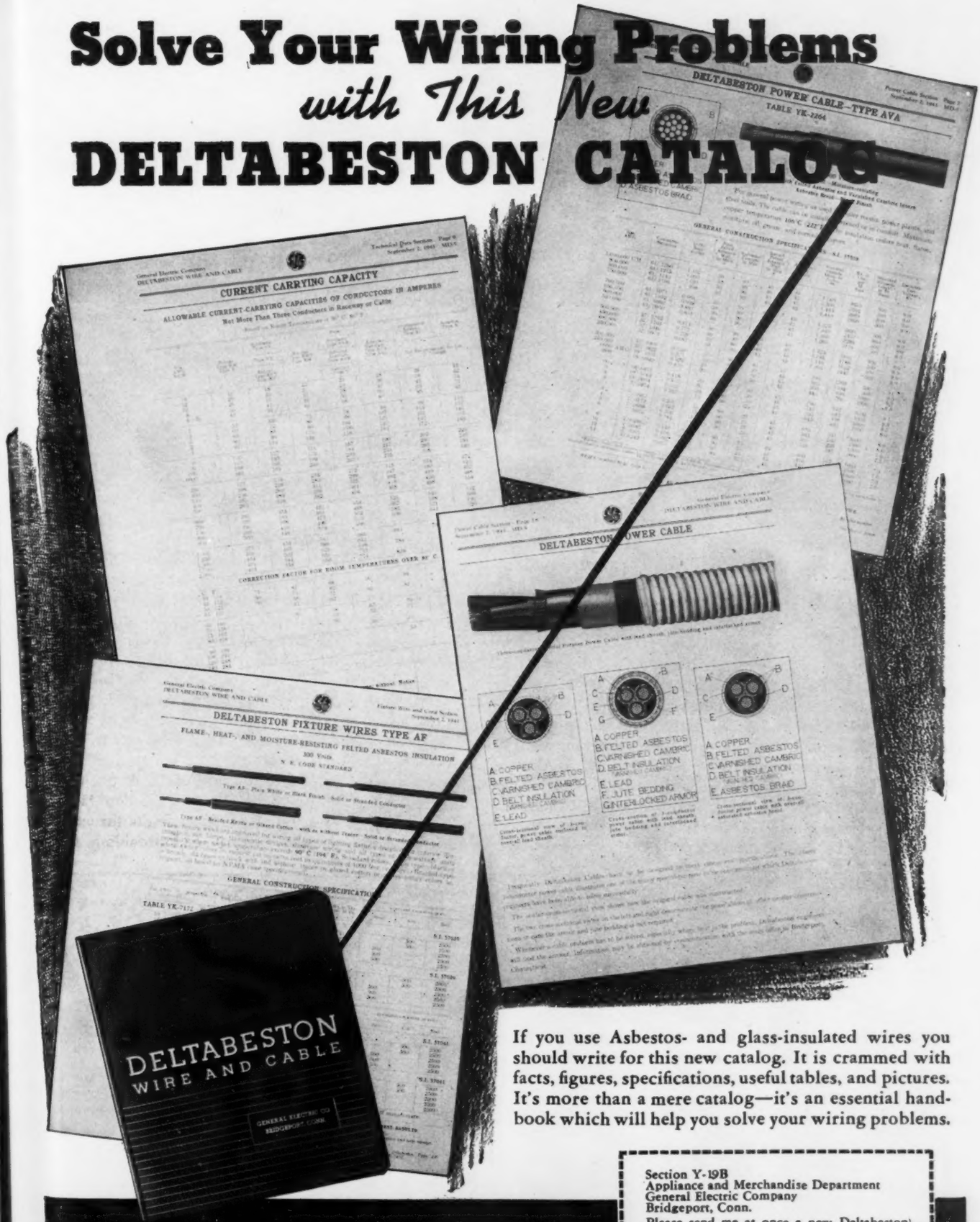
In connection with the addition of three 500-kva. transformers to an Eastern utility substation, three 4-kv. feeder regulators of the indoor type were available from another installation of the company to improve voltage conditions in the district. It was desirable to add these units to the substation without impairing the design symmetry and with due regard for flood protection and safety from contacts with live conductors. In common with other substations in an area not far from localities associated with the defense program, this substation, while non-attended, was locked and fenced at all times.

The transferred regulators were mounted outdoors as a bank on 6-in. channel-irons with 2½-in. angle cross-members, on a concrete base in line with the new transformer base and occupying an adjoining bay outside the bus structure. Clearance above the base was 22 in. The installation was fully metal clad, with ample separation from the 13-kv. bay occupied by the new transformers. Auxiliary wiring was run in rigid conduit to and from the regulators and all live contacts carried behind the units and above the head of any inspector visiting the installation to check up switch operations, relay and metering conditions.



UNIT INSTALLATION of transferred regulators proved economical

Solve Your Wiring Problems *with This New* DELTABESTON CATALOG



If you use Asbestos- and glass-insulated wires you should write for this new catalog. It is crammed with facts, figures, specifications, useful tables, and pictures. It's more than a mere catalog—it's an essential handbook which will help you solve your wiring problems.

Section Y-19B
Appliance and Merchandise Department
General Electric Company
Bridgeport, Conn.

Please send me at once a new Deltabeston catalog.

Name.....

Address.....

City.....*State*.....

GENERAL ELECTRIC

INDUSTRIAL ENGINEERING

Infra-Red Banks Dry Motor in Day

Eight years ago when high water flooded the lower half of a 250-hp., 2,300-volt motor at the Milwaukee, Wis., plant of the Globe Steel Tubes Company insulation resistance was brought back to normal by "baking" the motor for a week at 200–275 deg. in a large electric annealing furnace that was available. In June, this year, the same motor was flooded out again. But this time a different method was used to dry out the windings. Eighteen 250-watt, type R-40 infra-red lamps were trained on the windings. Insulation resistance returned to normal after 24 hours.

To do the job two banks of nine infra-red lamps each, borrowed for the purpose from the electric power company, were mounted on each side of the stator, as shown. Banks were first tilted at an agle of about 45 deg. Lamps were about 20 in. away from the bottom windings. Lamps were left in this position until it became evident from temperature readings that a "ceiling" was being reached. The banks were then shifted so that the lamps were about 12 in. from the windings and the rays fell almost vertically on the windings. Under this condition a maximum temperature of 225–230 deg. was attained.

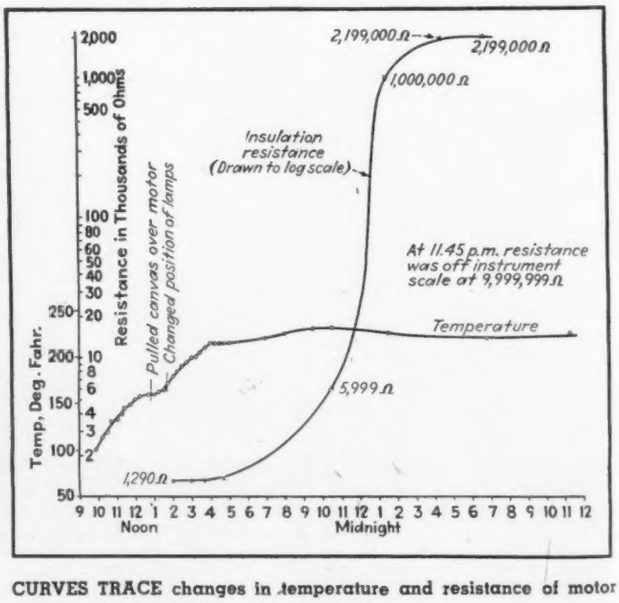
Temperature and resistance readings taken during the drying operation are shown on the accompanying graph. Resistance readings were taken with an L & N instrument with one terminal connected to a motor lead and the other to a bolt in the frame. Temperatures of the windings were given by an Alnor pyrometer with the thermocouple 2 in. in from the end of a slot in the bottom of the stator. The slot was covered to prevent direct radiation from affecting the readings. Depth of the slot and windings was about 5 in.

•

Transformer Shift Improves Voltage

In a New England plant manufacturing metal items required by war planes expansion of equipment increased the load to a point seriously affecting the voltage conditions on the 230-volt, three-phase power and the 115-volt lighting distribution circuits. On the latter the voltage dropped to a minimum of 95, making it difficult to start the existing fluorescent units. A survey by an outside organization led to a recommendation to expend about $25,000 in rebuilding the distribution facilities, running 4-kv. circuits throughout the property and providing nu-

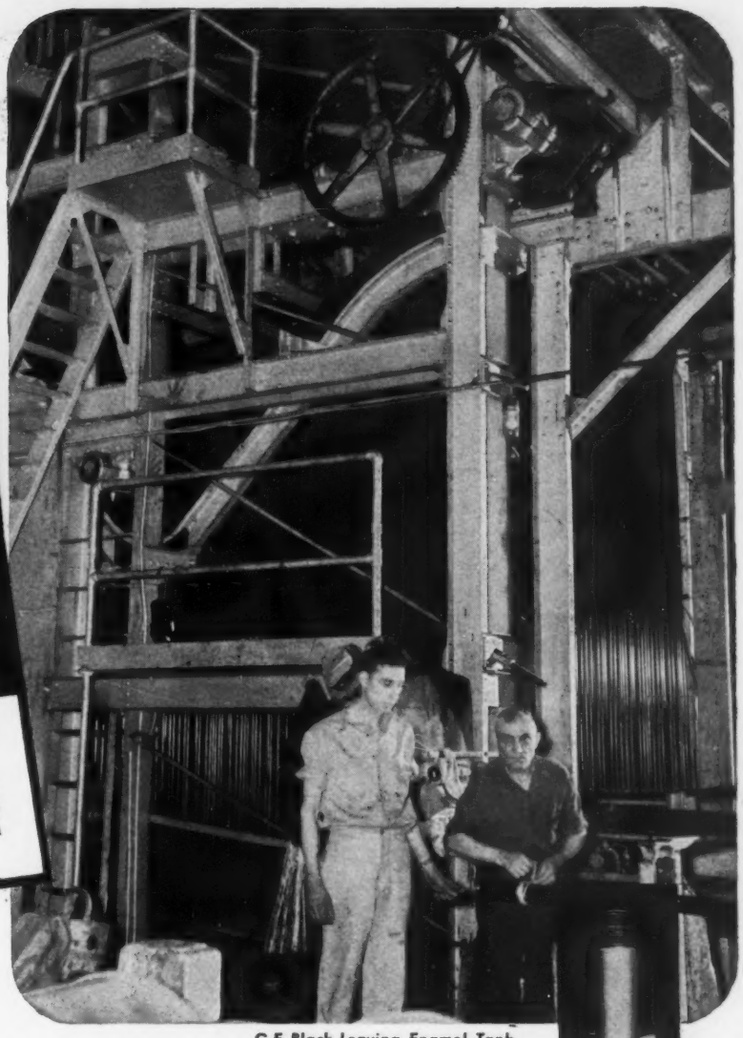
TWO BANKS of nine 250-watt R-40 lamps on 8-in. centers dry 250-hp. motor in 24 hours



CURVES TRACE changes in temperature and resistance of motor windings during drying out period

F. P. Serene, Enamelling Supervisor, Day Shift, at the G-E Conduit Factory, New Kensington, Pa.

Mr. Serene started at the factory 20 years ago in the threading department. Work in other departments followed. Since 1927 he has been supervisor of enamelling and contributing operations. Sixty men work under him.



G-E Black Leaving Enamel Tank

G-E BLACK
has protective coat of enamel

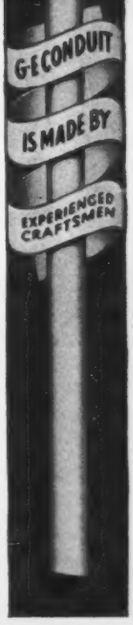
No. 3 of a Series—Men and Processes Behind G-E Conduit

G-E Black Rigid Conduit is made from easy bending, open-hearth steel tubing expertly processed by skilled workmen with long experience. Inspections and tests are made after each operation to insure uniform quality.

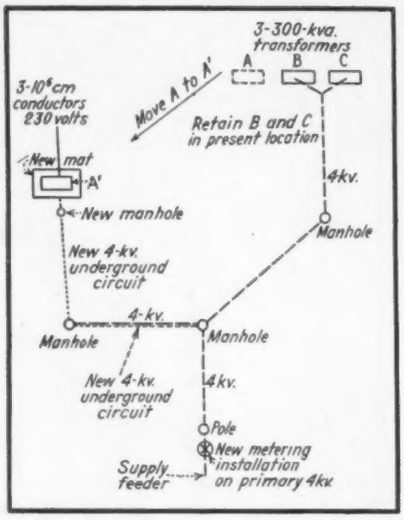
A tough, elastic, high quality enamel coating is baked on. It provides a durable corrosion protection where conduit is not exposed to weather or to excessive dampness. This coating is applied to carefully cleaned tubing by complete immersion, and adheres very tightly. It has uniform thickness on inside and outside surfaces. The glossy surface of this enamel assures easy, high speed wire pulling.

G-E Black is suitable for installation where no metal-coated conduit can provide adequate protection. Its enamel coating is chemically inert in the presence of corrosive liquids or fumes. When specifications call for chemical corrosion tests, compare G-E Black with any other coating.

For further information about G-E conduit see the nearest G-E Merchandise Distributor or write to Section C-19B. Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.



GENERAL ELECTRIC



TWO-POINT supply saves nine-tenths the estimated cost of reconstructing primary distribution system in defense plant

merous transformers at load centers involving about a dozen buildings. Extensive switching changes were also indicated. The above outlay was regarded as unduly high for the results desired and an analysis was made by the power sales and engineering departments of the local utility to determine a less expensive solution. The demand is about 900 kva.

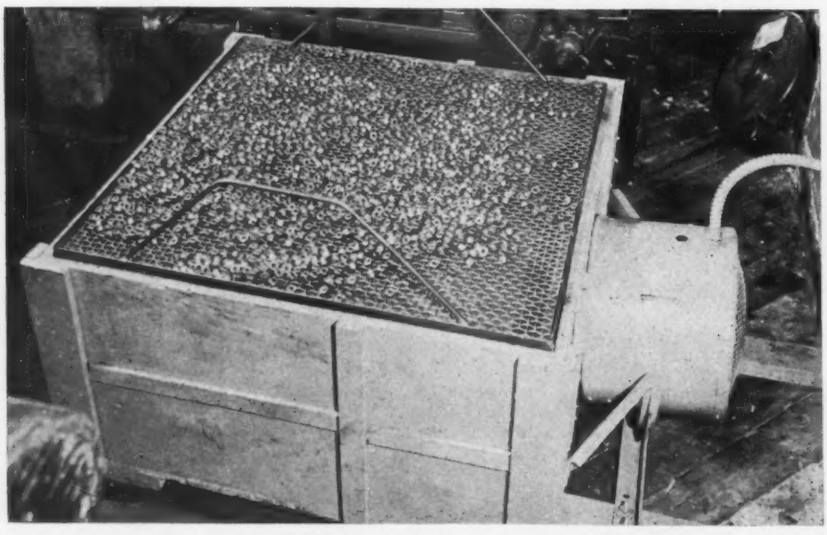
This was achieved by adopting a much simpler plan, involving the transfer of one 300-kva. transformer from a central bank of three such units to a new location at a growing load center, running about 500 ft. of No. 4, 5-kv., three-phase underground cable from a manhole near the incoming supply to the new location of the transformer and installing three 1,000,000-cir.mil conductors from the transformer secondary terminals to a new switch serving the adjacent building. The former arrangement for metering on the secondary side of the system was changed to primary metering at a pole standpipe where the 4-kv. supply entered the plant underground system. Solid cutouts were installed at the transformers in place of the previous primary fuses and Westinghouse "BA" (boric acid) fuses installed on the 4-kv. outside supply to protect all 4-kv. circuits in the property.

The new layout is designed to maintain normal lighting circuit potentials and between 219 and 242 volts on the three-phase power distribution circuits. Three electric hardening furnaces aggregating 10.1 kw. in rating, an electric annealing furnace of 12 kw. capacity and 200 100-watt fluorescent lighting units have recently been installed. The cost of the changes effected in the transformer location and related wiring and conduit facilities was but $2,500.

•

Unit Electric Heater Used to Dry Bearings

By using a forced-convection electric heater mounted at the side of a wooden frame flexible steel bearings are dried quickly and effectively at the rate of as many as 50,000 bearings per day. The novel drying equipment is used in the plant of the Harris Products Company, Cleveland, Ohio, and was evolved by the company's engineers.



WASHED ball bearings being dried by a forced convection electric heater

After a coating of petrolatum is washed from the bearings in a solution of strong soap, the bearings are placed on a screen tray which fits into the top of a box frame.

Air from a General Electric 5,000-watt forced convection unit heater is then blown into one end of the inclosing box and passes up through the parts which are lying on the screen tray.

•

Portable F Lamps Aid Plane Production

LOCKHEED WORKER checks plane structure by light of portable fluorescent lamp

A portable fluorescent lamp incased in a transparent Lucite tube is proving invaluable to aircraft workers at the Burbank, Calif., plant of Lockheed Aircraft Corporation. Light in weight, of low wattage and resistant to rough working conditions, the portable F lamp provides craftsmen with line source lighting, eliminating shadows in limited working areas. In addition to aiding many of the 18,000 on night shift crews inside the plant, the light is doubly helpful where overflow assembly lines have moved outdoors. The auxiliary for the lamp is either attached to the plug or is carried in a plug box to which the lamps are attached.

Manufactured by Day-Ray Products of South Pasadena, Calif., the Lucite-incased F tubes are well insulated, extremely durable and afford high light transmission for technical workers on Lockheed's famous "P-38" and other models.

5/8% step regulators give you Narrow Band Widths WITHOUT 200% HIGHER EXCITING CURRENT!

llis-Chalmers DFR Regulators Easily Hold 2-Volt ands . . . Yet Need Only 1/3 the Exciting Cur- ent Required by Older Types of Regulators.

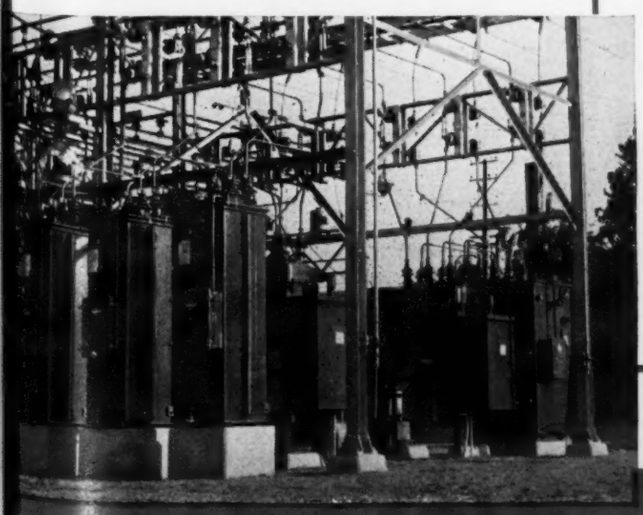
CTUAL TESTS by utility engineers have proved that llis-Chalmers 5/8% Step Regulators need *only 1/3 the citing current required by older types of regulators!* Vattless current is cut 67% . . . more system capacity eleased for pay loads . . . fewer capacitors needed!

That's one reason why more and more systems are king advantage of the savings of the Allis-Chalmers FR — the only station-type step regulator for single- ase, 2400 and 4800 volt feeders on the market today. ere's another . . .

The Allis-Chalmers DFR Regulator easily holds narrow band widths — as low as ±3/4 volts on some feeders. There are no compounding or hold- ing coils . . . the relay is free to follow each voltage fluctuation without excessive damping.

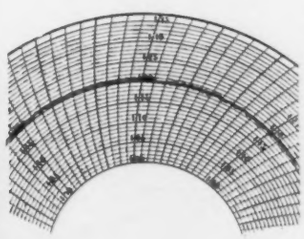
Important, too, are DFR's reduced losses, quieter operation, and minimum maintenance costs — all new standards in feeder voltage regulation.

Why not let an engineer in the nearest Allis-Chalmers district office show you how the Allis-Chalmers 5/8% Step Regulator can bring better regulation at lower all-around cost to your system? Call him today. Or write direct to Allis-Chalmers, Milwaukee, for your copy of Bulletin B-6065. A 1408



On the lines of a southern utility—three 72 kva, 2400 volt Allis-Chalmers DFR's (foreground) and one 216 kva, 4160 volt 5/8% Step AFR Regulator.

5/8% STEP REGULATORS Have Been Holding 2-VOLT BANDS FOR 7 YEARS!



When the Allis-Chalmers 5/8% Step Regulator was designed over eight years ago, the size of steps was selected as 5/8 of 1% because data gathered from utilities all over the country indicated that the 2-volt band was .desirable.

A look at the accompanying chart —the actual record during operation on the lines of an eastern system — will show you how the Allis-Chal- mers DFR *easily* holds a 2-volt band.

hese 5/8% Step Regulators Are Famous or Better Regulation at Lower Cost! hoose the Regulator to Fit Your Purpose!

FR – 12 to 250 kva, single phase
FR – 208 to 750 kva, three phase
FR (air cooled) – 36-96 kva, 2400 volt, single phase

ALLIS-CHALMERS

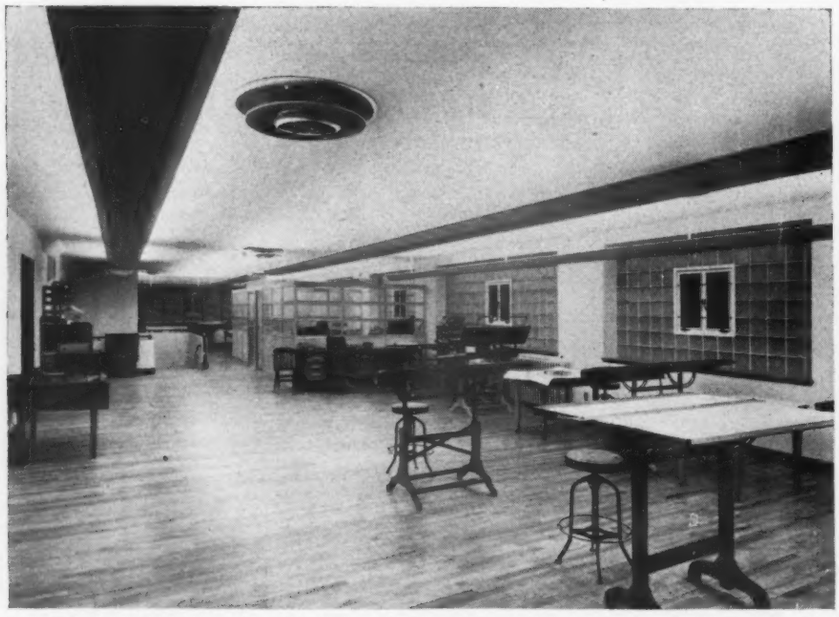
MILWAUKEE·WISCONSIN

LOAD BUILDING

65 Ft.-Candle Indirect Light Drafting Room

Mueller Furnace & Boiler Company's drafting room in Milwaukee has recently been added to the growing list of indirect fluorescent lighting installations in the Middle West. Here a net working area of 1,850 sq.ft. is lighted to 100 initial foot-candles (65 foot-candles final) at a cost of $1.03 per sq.ft., including fixtures, switches and lamps, without labor. Gross wattage is 8,930 watts or 4.83 watts per sq.ft. net.

The 39 Curtis trough units, each housing two 100-watt white lamps, are arranged in continuous rows 8 ft. apart with a 32.5 in. over-all suspension. The room has an 11-ft. ceiling and is 82 x 25 ft., including stairwell and toilet. Ceiling of the air-conditioned room is painted flat white and has an estimated reflection factor of 75 percent. Grasswold & Johnson, Milwaukee, were the architects.



INDIRECT fluorescent lighting provides 65 ft.-candles (final) in this drafting room

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Appliance Service Training in Georgia

By H. F. WOODALL
Appliance Service Superintendent
Atlanta Division, Georgia Power Company

At least four years of supervised training and experience are required to make a man competent in appliance service and repair. Trained and experienced for this length of time, he is able to handle 95 percent of customer calls and do the job right on the first call. This is the theory on which the Georgia Power Company trains its customer service personnel and which is now established in a fairly definite routine of field and shop work designed to develop skill and responsibility.

The new man entering the appliance service department has a high school education or better. Depending on his ability and aptitude for the job and on the need for trained men in the department, he will work for six months to two years as a helper in appliance delivery and installation. If he shows up well he will enter the repair shop in the fall after his employment. There he remains for six weeks, working with experienced men in reconditioning and repairing all kinds of appliances, doing the simple and often dirty work that usually falls to the beginner. Then he goes out on a service truck as a helper for six weeks to two months, learning all he can. Now rated as a "comer," he goes back into the shop, where for six weeks he handles more important work on his own. Follows now another period, four or five weeks, on the truck as a helper, this time with another man than the one with whom he worked previously. Successfully through this stage, he is assigned to a truck by himself and is qualified to handle the simpler calls that constitute about 60 percent of the total.

Through the next winter he alternates between shop and truck as before, continuing the outside work on the easier calls, but getting specialized training directly under a foreman on washing machine, refrigerator and refrigerator compressor repairs, a month to six weeks on each. The next summer he is out again on the truck, able to handle some of the more difficult jobs.

The schedule of shop and field training continues thus through the fourth year, each year marking a definite step upward in skill, until at the

MORE TIME . . . MORE ENERGY

You can help Industry get these 2 vital essentials!

VICTORY used to ride in a chariot. Today she prefers a plane or a tank . . . or maybe a motorized gun carriage.

To make a plane, a tank or a gun calls for men, machines, materials—and time and energy. Today, every ounce of energy and every minute of time counts.

Industry is fortunate to have the efficient new light source represented by G-E MAZDA F lamps. Already it is helping thousands of defense plants reach new peaks of efficiency.

It saves time—new high levels of lighting mean better sight—for faster, more accurate production. And by preventing the needless squandering of human energy it makes workmen more efficient and more productive.

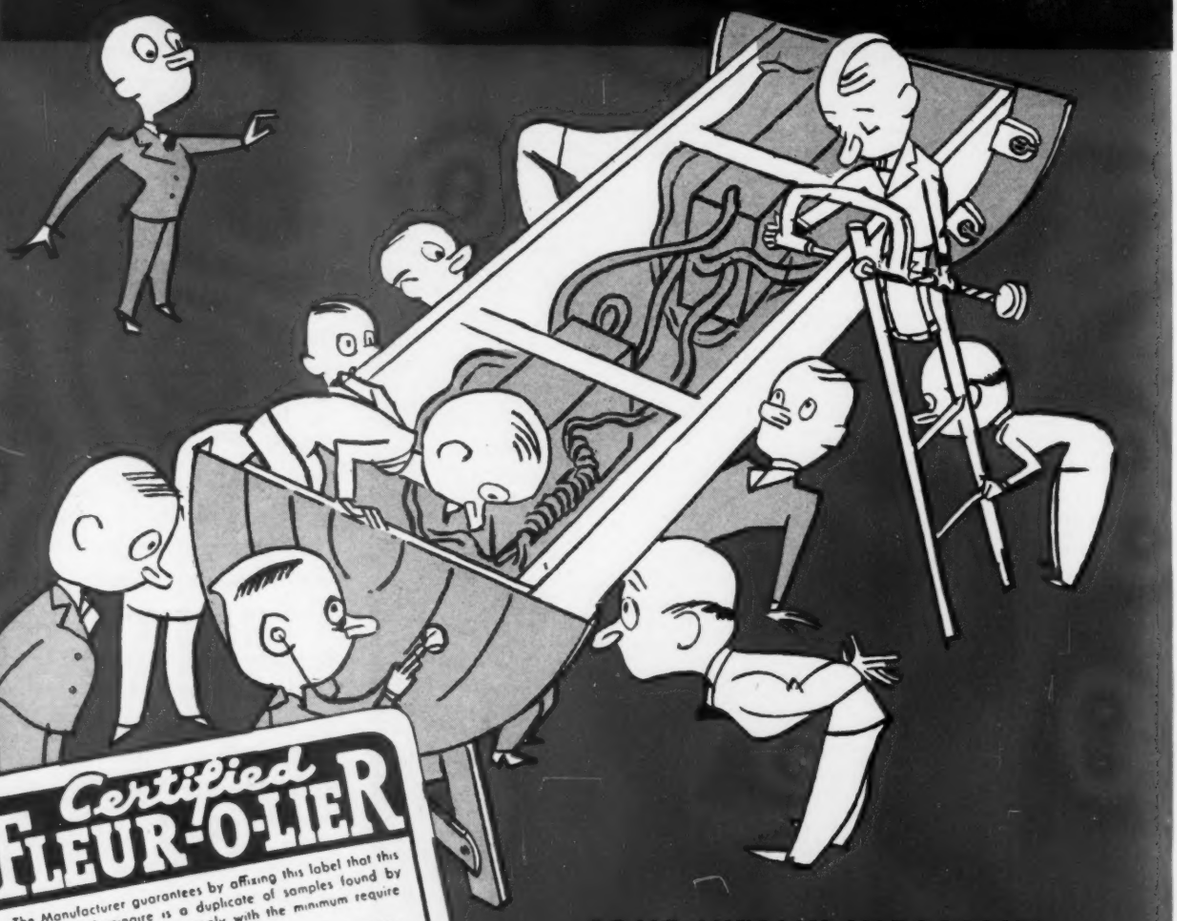
For years lighting companies have been telling the story of greater efficiency with better lighting. Maybe you're a little tired of it. Maybe you want something new and startling to tell your customers.

You've got it! The Science of Seeing *is* news to your customers. They're just *beginning* to catch on—and G-E fluorescent lighting makes the story more powerful than ever.

G-E MAZDA *Fluorescent* LAMPS

GENERAL ELECTRIC

TESTED



Certified
FLEUR-O-LIER

The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the

"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"

which are sponsored by the Manufacturers of Mazda Lamps.

ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.

E·T·L

A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE

E·T·L

FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW

THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

SOME VITALLY IMPORTANT REASONS WHY UTILITIES EVERYWHERE RECOMMEND CERTIFIED *FLEUR-O-LIERS!*

- Flicker correction
- Ease of maintenance
- Durability and safety
- High power factor (over 85%)
- Dependable ballasts and starters
- Efficient lighting performance

50 different ways!

Certified FLEUR-O-LIER Fixtures

give you 50 safeguards that mean dependable, balanced operation, top lighting performance... FLUORESCENT LIGHTING AT ITS BEST! See how FLEUR-O-LIER'S powerful 4-point program works to your advantage!

TESTED!

on 50 vital points, including flicker correction and high power factor, FLEUR-O-LIER fixtures give you safe, dependable service.

CERTIFIED!

by famous Electrical Testing Laboratories as meeting these 50 specifications, set up by MAZDA Lamp manufacturers for the protection of you and your customers.

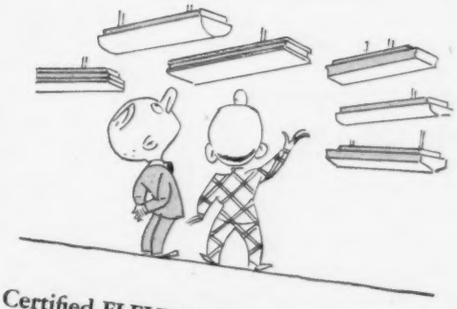
GUARANTEED!

Over a score of leading fixture manufacturers make Certified FLEUR-O-LIERS in 125 different sizes and designs . . . every unit carries the FLEUR-O-LIER guarantee.

ADVERTISED!

Powerful national advertising in Saturday Evening Post, Newsweek, Time, trade and business publications tells your customers the advantages of Certified FLEUR-O-LIERS!

WIDE CHOICE!



Certified FLEUR-O-LIERS are available in 125 different sizes and designs—for commercial and industrial uses.

USE THE COUPON BELOW—get new booklet giving valuable information together with complete list of FLEUR-O-LIER Manufacturers.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

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2126-12 Keith Bldg., Cleveland, O.

Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name _____

Address _____

City _____ State _____

end of the time the candidate has become a full-fledged service man able to respond satisfactorily to all except the few calls that require the attention of a specialist. This means that he can be sent out in full confidence on 95 percent or more of all the calls that come in. Through his period of training the man has had successive raises in pay as he has gained competence.

Accompanying the four-year course is attendance at periodic local training schools as they may be staged by manufacturers for instruction in maintenance and repair of their products. When the course is finished the man is then eligible to be sent for advanced specialized training in schools conducted at manufacturers' plants.

There are no set terms nor any formal examinations in the course. A man may take less or more than four years to complete it, depending, as earlier stated, on his aptitude and on the need for service men. The progress a man makes is gauged by observation of his immediate superiors in the department and as he goes along he must show to them his ability to learn and to apply what he has learned.

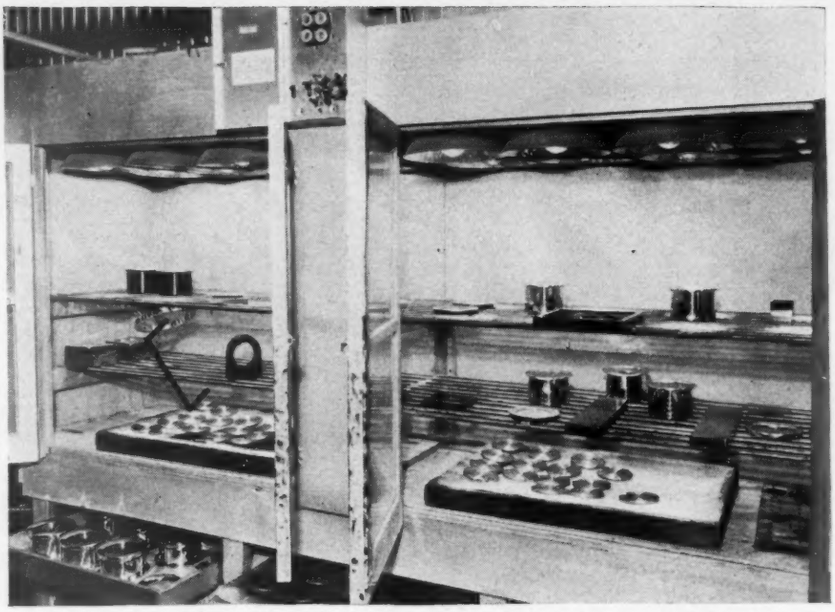
•

Infra-Red Speeds Clock Output

Drying of lacquered parts by infra-red lamps has been reduced in time at the Chelsea (Mass.) Clock Company plant from an average of 1.5 hours to about five minutes for the entire range of parts treated. The work was formerly done by a space-heating unit in a small cabinet, but with an infra-red installation of sixteen 260-watt lamps in a cabinet 8 ft. long x 43 in. high x 23½ in. deep the heat is better concentrated, control improved by subdividing the units into four sections and a wide range processing set-up achieved.

In the earlier days it was necessary to allow 24 hours for lacquer to dry enough to handle. With the present layout the lacquer receives harder drying than ever before, and Walter E. Mutz, vice-president and plant superintendent, states that this hardness is of particular advantage where a clock is to be engraved, since with it the lacquer does not "lift" as it often did in the past.

Small orders in the company's varied line can be run through the infra-red cabinet as conveniently as the more common bulk shipments in process. The lamps are mounted in two rows of eight each at the top of the cabinet, with a separate switch controlling each group of four, mounted in a Wadsworth fuse and switch panel box. Material is supported while being heated either on ½-in. metal rods forming two continuous shelves inside the cabinet, or on trays. The rods are spaced 2½ in. apart on centers, eleven maximum being provided per shelf. The sides, bottom and rear of the cabinet are insulated with ⅜-in. asbestos board. Boston Edison supplies electrical energy to the plant.



INFRA-RED HEATING UNITS are mounted in dustproof cabinet to insure more perfect product surfaces on clock parts

•

Fluorescent Light's Effect on "Color"

By O. P. CLEAVER
Westinghouse Lamp Division,
Westinghouse Electric & Manufacturing Company,
Bloomfield, N. J.

Because various objects look different under artificial lighting to different people, Westinghouse Lamp Division recently conducted a series of tests over a period of several months. Four types of test objects were used: Meats, fruits and vegetables; human skin; wood finishes and wall colors. Test objects were viewed against a light-gray background under four colors of light—incandescent (100-watt lamps), 3,500 deg. white, daylight and soft white fluorescent. Illumination level in all instances was 50 ft.-candles. Observers included a number of men and women—architects, decorators, engineers and John Doe.

Results of the tests on meats, fruits and vegetables are given in the accompanying table; data on the other test objects are obtainable from the Lamp Division. It is emphasized that the tests are intended to serve only as guides, rather than as exact rules to the proper application of artificial lighting.

Effect of Fluorescent Lighting on Meats, Fruits and Vegetables
(Illumination Level—50 Ft.-Candles)

Test Article	Daylight Mazda F	3,500 Deg. White Mazda F	Soft White Mazda F	Filament (100 Watt)
Red meats	Poor	Fair	Good	Preferred
Dressed chicken	Poor	Fair	Good	Good
Butter	Poor	Good	Good	Preferred
Chocolate	Poor	Fair	Fair	Good
Bread (brown crust)	Fair	Good	Good	Good
Oysters (opened)	Poor	Poor	Fair	Preferred
Parsley	Good	Good	Fair	Poor
Carrots	Good	Good	Good	Good
Tomatoes	Fair	Fair	Fair	Preferred
Red apples	Fair	Fair	Fair	Preferred
Onions	Poor	Fair	Fair	Fair
Green apples	Good	Good	Fair	Poor
Squash	Fair	Good	Preferred	Good
Bananas	Fair	Good	Good	Good
Red and green peppers	Fair	Good	Good	Good
Green beans	Good	Good	Fair	Fair
Cauliflower	Poor	Poor	Good	Good
Green cabbage	Fair	Poor	Fair	Fair
Red cabbage	Fair	Fair	Good	Preferred
Corn	Good	Preferred	Good	Good
Lemons	Poor	Poor	Fair	Good
Peaches	Good	Good	Good	Good
Oranges	Fair	Fair	Good	Preferred
Plums (reddish purple)	Fair	Good	Preferred	Good

What's your outlook for '42?

MILLER-IVANHOE asks...

- **Does defense demand your industrial customers do more nightwork?**
- **That they get more out of present men and machines?**
- **That they hold high precision on subcontracts?**

UTILITY LIGHTING ENGINEERS HELPING DEFENSE:

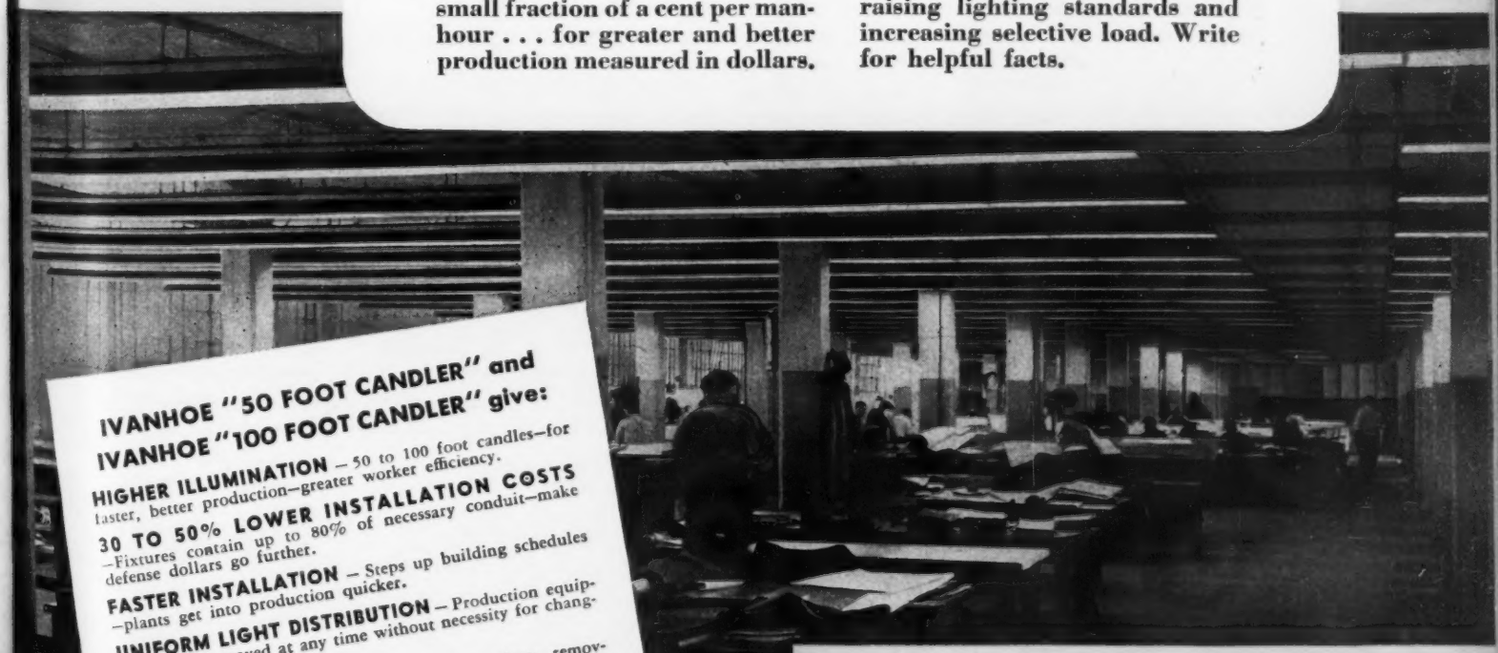
There is no excuse today for prime contractors and subcontractors being "slowed down" by poor lighting. Not when they can have 50 foot candles or better in their plants with IVANHOE "50 FOOT CANDLER," IVANHOE "100 FOOT CANDLER" and MILLER TROFFERS for their offices.

Five years ago they couldn't buy this grade of "seeing" at any price. Today it will cost them a small fraction of a cent per man-hour . . . for greater and better production measured in dollars.

Utilities like these ORIGINAL continuous fluorescent lighting systems, because they are fully guaranteed, and because they have *proven* their ability to deliver such benefits in installations of all kinds under exacting defense conditions. Lighting experts have pronounced them, "*the new lighting standard for industry.*" They will definitely help your customers . . . and they will definitely help you by raising lighting standards and increasing selective load. Write for helpful facts.

Prompt Deliveries—Superlative Service

We are constantly striving to keep deliveries moving smoothly, fast and ahead of building schedules. And no major installation goes in without a Miller-Ivanhoe engineer on the scene . . . to live with the job until it is operating with maximum results for you.



IVANHOE "50 FOOT CANDLER" and IVANHOE "100 FOOT CANDLER" give:

HIGHER ILLUMINATION — 50 to 100 foot candles—for faster, better production—greater worker efficiency.

30 TO 50% LOWER INSTALLATION COSTS —Fixtures contain up to 80% of necessary conduit—make defense dollars go further.

FASTER INSTALLATION — Steps up building schedules —plants get into production quicker.

UNIFORM LIGHT DISTRIBUTION — Production equipment can be moved at any time without necessity for changing lighting.

SIMPLIFIED MAINTENANCE — Easy to clean, removable porcelain-enamel reflectors—save valuable man-hours for production.

ALLOWANCE FOR FUTURE LIGHTING NEEDS —Illumination increases up to 45% practical without new fixtures—lower obsolescence.

THE MILLER COMPANY

MERIDEN, CONN.

Pioneers in Good Lighting Since 1844

• MILLER OFFERS A COMPLETE LINE of incandescent and fluorescent lighting equipment, backed by almost 100 years of commercial and industrial lighting specialization. There is an answer to your problems in this unbiased lighting service.

NEW ENGINEERING IDEAS

Electrolytic Cell Recovers Mercury

An ingenious electrolytic device that recovers mercury from the waste acid solutions of the mercury purification process used by the Commonwealth Edison Company has been developed by B. F. Freeberg and H. R. Alley, chemists in the company's testing department. The device, now a standard piece of equipment in the company's testing laboratories, retrieves approximately 150 lb. of mercury annually which would otherwise be wasted. Since the cost of this metal today is upward of $2.50 a pound, the device effects a worthwhile saving to the company.

ELECTROLYTIC CELL recovers mercury from waste acid by-product of mercury purification process

It saves substantial amounts of mercury for use in mercury arc rectifiers. At left is H. R. Alley; right, B. F. Freeberg, who developed the device

For satisfactory performance, the large quantities of mercury used in the company's mercury rectifiers must be kept scrupulously clean. Dirty mercury is purified in the laboratory by filtration acid washing and distillation in glass vacuum stills. In the past a substantial amount of mercury has been lost through chemical attack during the acid washing phase of the purification. Until the Freeberg-Alley reclaiming device was perfected no effective method had been found to recover the metal dissolved in the acid.

The new device consists of an electrolytic cell with a platinum wire anode and mercury pool cathode supplied with direct current by a selenium rectifier. In the recovery operation about ⅓ gal. of waste acid containing mercury salts and residues is poured into the cell and the cell energized. Direct current of about 1½ to 2 amp. is passed through it at 8 to 10 volts potential. Mercury compounds in the waste acid solution and residues are converted by electrolysis into relatively pure mercury which is deposited at the cathode of the cell and drained off through a siphon tap at the bottom. From two to three days are required to process ⅓ of a gallon of solution, from which about 1 lb. of mercury is recovered. About 2 kw.-hr. is required to recover a pound of mercury. Current efficiency is between 60 and 65 percent. It is estimated that about 50 gal. of acid solution is processed in this manner in a year at the company's laboratory.

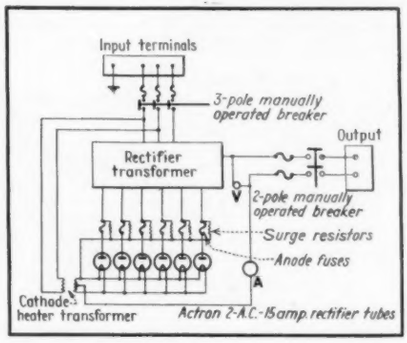
Although the device was designed to solve a specific laboratory problem, many of the industrial engineers and consulting electrochemists who saw the apparatus in operation at the recent annual meeting of the Electrochemical Society in Chicago expressed the view that it could be adapted to many other applications contributing to the conservation of a metal vital to national defense.

•

Special Rectifiers Assist Changeover

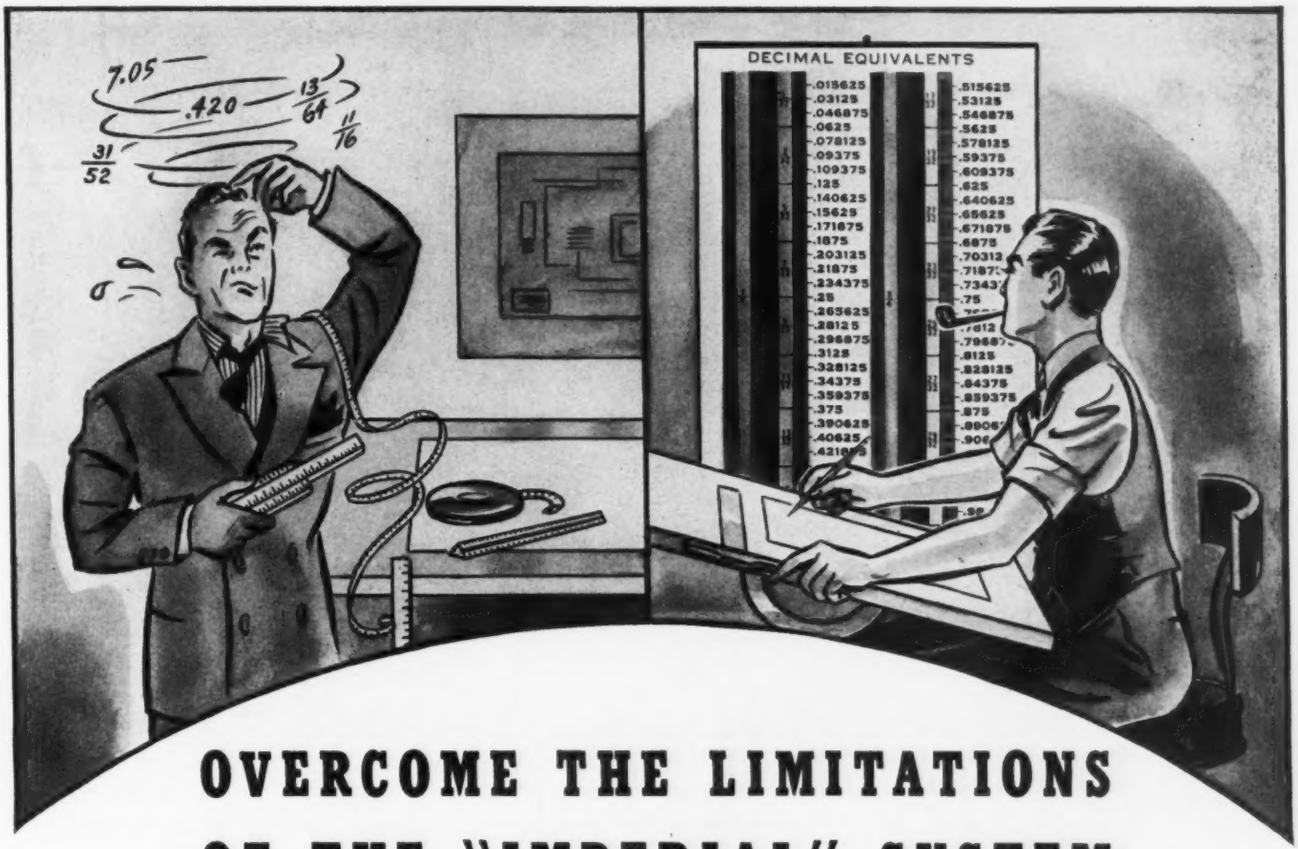
Self-contained, pre-assembled and air-cooled mercury-vapor power rectifiers recently designed by Allis-Chalmers Manufacturing Company for metropolitan and industrial areas where d.c. and a.c. changeover is in progress, or recently completed, are built around a special hot-cathode mercury-vapor tube. These rectifiers also incorporate several novel internal circuit protection features.

The hot-cathode mercury-vapor tubes used employ a heavy carbon anode that is intended for moderate-temperature operation. It allows even temperature operation of the tube and acts as a buffer to heat shock that will tend to occur under sudden increases in load. A non-sagging,



SELF-COOLED, mercury-vapor power rectifiers have novel circuit protection features

How do YOU *do it?*



OVERCOME THE LIMITATIONS OF THE "IMPERIAL" SYSTEM

- The "IMPERIAL" is the customary system of measurement used in the British Empire and in the U. S. A.

  From the beginning of time, man has striven to unify and simplify his measurements.

- The "CUBIT" . . . oldest known measure of length, varied, but averaged 21.8" . . . Egypt had 3 different cubits, 17" for the common man, 21" for the King, and 35" for the Sanctuary.

- The "FOOT" . . . originated in Greece . . . became the standard unit of length in the early Olympic Games . . . reputed to be the length of Hercules' foot. Romans based their system upon the Greek method, and forced their Romanized code of measurement upon England. When Britain was again free, this Roman-Greek system was modified . . . and thus started the "IMPERIAL" system.

- The "YARD" . . . originally the circumference of a man's body, later the length of the first King Henry's arm . . . still later became a multiple of the foot.

- The "INCH" . . . the length of 3 barley corns . . . later became 1/12th of a foot.

- THE LIMITATIONS ARE THAT THESE UNITS ARE NOT MULTIPLES OR UNITS OF DECIMALS.

  Modern Engineering and Manufacturing demand flexible and precise standards . . . hence the use of Decimal Equivalents.

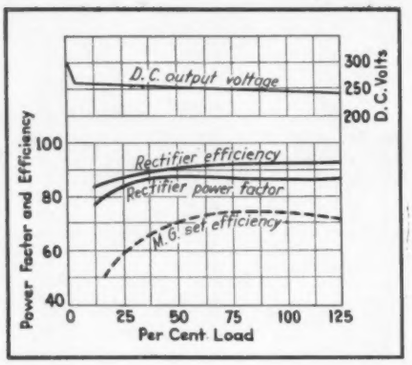
  Time will not permit individual interpolations.

- The CONTINENTAL-DIAMOND Decimal Equivalent Chart is an indispensable aid to crash through the limitations of the "IMPERIAL" system . . . in colors . . . 23" x 35" . . . easily read . . . gives Decimal Equivalents from 1/64th" to 64/64"

  Write today for your free copy. Address
  No. 12 Chapel Street, Newark, Delaware

Continental - Diamond FIBRE COMPANY

"Manufacturers of Laminated Plastics Since 1911" — NEWARK • DELAWARE



UNIFORM high efficiency compared to rotary equipment

low-temperature cathode construction avoids any change in distance between anode and cathode during operating life and eliminates aging effects common to electronic tubes.

Electrical characteristics of the tube are as follows:

Filament voltage, volts	2.5
Filament current, amp	18.0
Average current output, amp. max	15.0
Crest current output, amp. max	50
Max. forward working volts	250
Inverse peak voltage	750
Arc voltage	6
Ignition voltage	9
Starting time, minutes	3

Overload circuit breakers on the a.c. and d.c. lines protect the unit and act as disconnect switches both for input and for load. Time-delay characteristic prevents them from tripping under instantaneous peak load, but allows complete protection from sustained overloads.

Individual anode fuses, which will open any individual tube circuit in a period of ½ cycle, protect the tubes against extreme overload or arc-back. Surge arresters are also provided across each secondary winding to protect the transformer equipment against high-voltage breakdowns.

Accompanying performance curves for the 15-kw. unit, 250-volt operation, show a rectifier efficiency range from 25 to 125 percent load of 87 to 92 percent, which compares with motor-generator set efficiency over the same range of load of 60 to 75 percent. Power-factor curves shown are for an average value of line reactance and may vary somewhat where inherent system reactance is high.

While present maximum rating of units is 15 kw. at 250 volts, additional capacity may be secured by paralleling units.

Life Expectancy of Fluorescent Lamps*

Although it is impossible to predict when individual fluorescent lamps will burn out, it is quite possible to predict the number of lamps that will fail in any given group of lamps used in any period of time, if the conditions are known and particularly if the group is quite large.

To develop a relamping or maintenance program that will provide the maximum satisfaction at the minimum cost, life expectancy curves which are similar to actuarial data for humans are used for the fluorescent lamps.

Few, if any, of the initial lamps will fail during the first few hundred hours of service. But as the group of lamps ages an increasing number will burn out, with the rate of mortality being the greatest at or near the average life point. A few of the lamps will remain in service for a considerable period of time, developing the lower part of the mortality shown in Fig. 1.

From the mortality curve of initial lamping the following conclusions may be made:

1. About half of the lamps will have burned out when the average life point is reached.
2. A few lamps will burn out quite early.
3. A few lamps will live far beyond the normal life expectancy of the group. (Note: The average of the group cannot be determined until these lamps have burned out.)
4. Most of the lamps will burn out near the average life point.
5. The rate of failure varies widely, rising gradually to a peak at the average life point and then diminishing as new lamps are installed.

During the life cycle of the initial lamping replacements will be necessary. The life performance of the initial and subsequent relampings is shown in the replacement curve, Fig. 2. The renewal rate for any given installation varies widely for the first few lampings, and then levels out to an average rate determined by the number of lamps, type of lamps and hours involved.

Approximate number of lamps per month or per year that will need to be replaced after the replacement curve levels out can be estimated from the following formula:

$$F = \frac{H \times O}{L}$$

where F = number of failures, H = hours burned, O = number of outlets and L = rated lamp life.

This is the formula that should ordinarily be used, although deviation from this average replacement rate must be taken into account during the first few lampings as shown by both the mortality curve and the replacement curve.

*Excerpt from "Planning for Maintenance," by E. W. Beggs, Westinghouse Lamp Division, Bloomfield, N. J., recently presented before Illuminating Engineering Society at Atlanta, Ga.

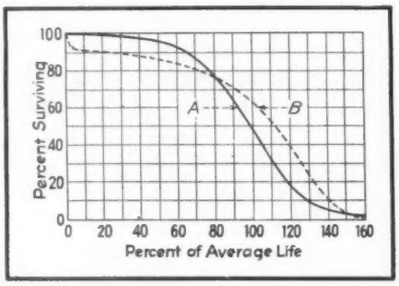


FIG. 1—Mortality curves: A—for Mazda F lamps; B—for white males, U. S. Census 1930

Mortality rate of the initial lamping of fluorescent lamps as contrasted with human beings. Burnouts tend to bunch near the average life of the lamp.

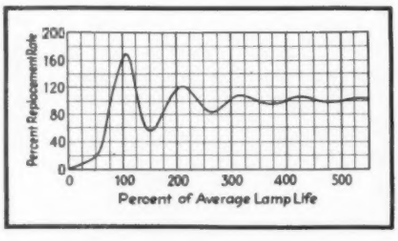
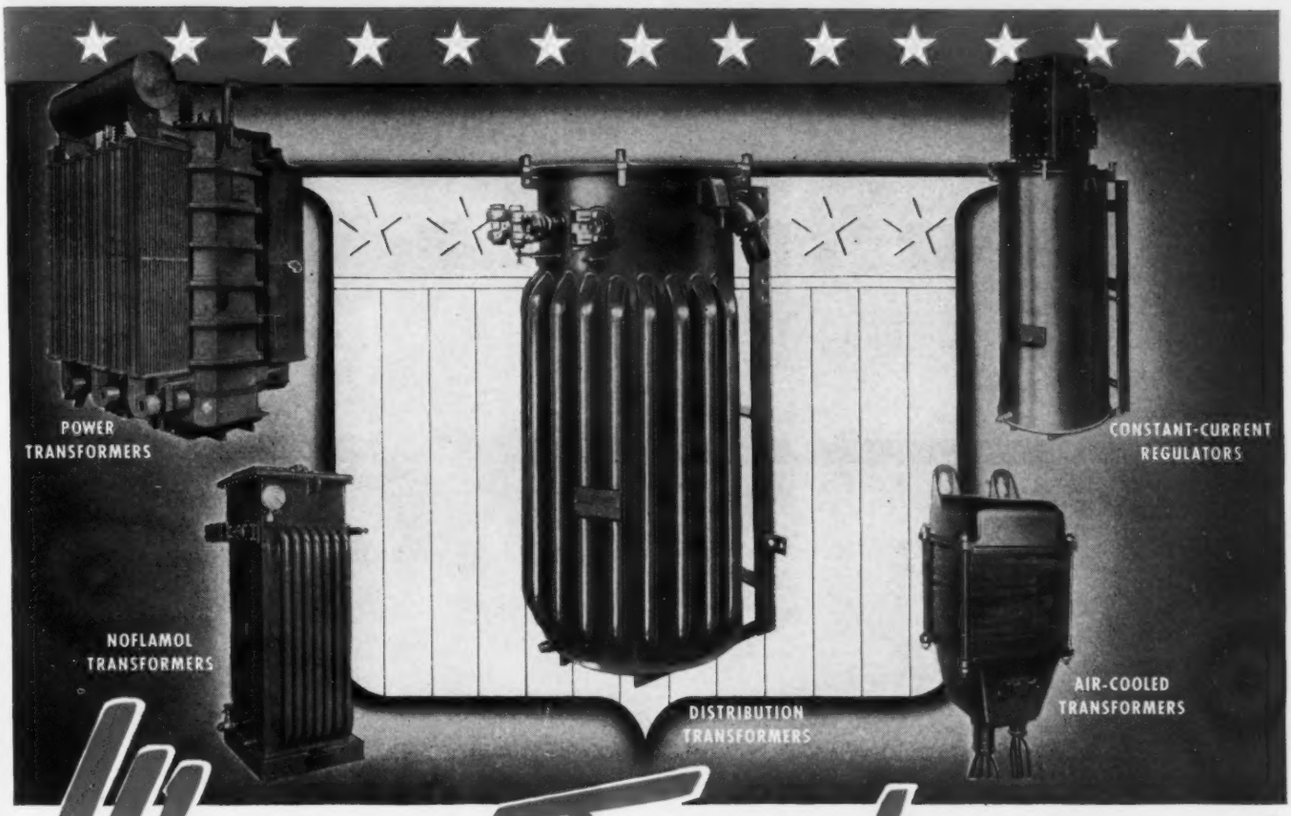


FIG. 2—Replacement rate for Mazda F lamps; theoretical, based on mortality curve

After a fluorescent lighting system has been in operation for a few years new lamps will be mixed with old and the renewal rate reaches an equilibrium.

New Hardware on Boulder Lines—II

Captions under the two illustrations accompanying this article in ELECTRICAL WORLD for November 15, 1941, p. 94, were inadvertently transposed. The Goss damper, a 13-lb. spherical weight bolted on the type HH cable was also incorrectly shown in a vertical position. As the caption indicates, the damper is installed on the cable in a horizontal plane, not hanging downward as the picture shows. In this way, it tends to oppose any untwisting of the hollow-conductor cable.



Wagner Transformers

GIVE DEPENDABLE SERVICE IN DEFENSE PRODUCTION

IN defense industries .. power plants .. air ports .. government construction work — wherever the use of dependable electric power is an important factor, you will find Wagner transformers doing their part in speeding up our national defense program.

Wagner transformers, through 50 years of service to industry, have proved their ability to furnish unfailing power, and it is only natural that they should be selected for the key points of power distribution in this time of national emergency.

Wagner builds all types and sizes of power and distribution transformers including stud-bushing type; primary-pocket-stud type; sub-station and subway types; single or three phase; rural line; air cooled; Noflamol; and Type YH Constant-Current Regulator.

Because of large plant capacity, vast manufacturing facilities, and 50 years of engineering and manufacturing experience, Wagner can give immediate attention to all your transformer requirements.

SEND FOR COMPLETE LITERATURE

For complete descriptive literature on the design and construction of Wagner transformers write for bulletins TU-180 (distribution) and TU-181 (power).

T41-14

WAGNER ELECTRIC CORPORATION 50TH ANNIVERSARY 1891 • 1941 ST. LOUIS, MO.

This year Wagner celebrates its fiftieth year of service to industry and the home — as a manufacturer of transformers, motors and fans of the highest quality.

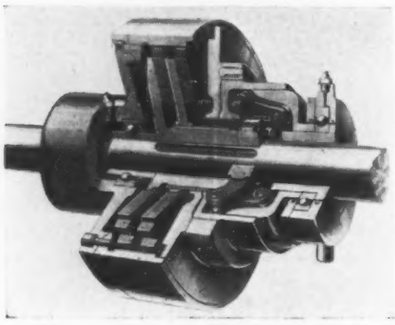
Wagner
ELECTRIC CORPORATION
6400 PLYMOUTH AVE. ST. LOUIS, MO., U. S. A.

★ TRANSFORMERS
★ MOTORS
★ FANS
★ BRAKES

NEW EQUIPMENT

Clutch

Friction clutch is designed for impact and pulsating loads and all parts are totally inclosed. Friction plates are of gear



"Torque-Master" friction clutch; single and multiple-disk types, wide range of sizes. **T. B. Wood's Sons Co.**, Chambersburg, Pa.

tooth design. Adjustment for wear or load conditions is made with one knurled hand adjusting ring.

•

Drying Lamp

Infra-red drying lamp; 100-watt size. **Westinghouse Lamp Division**, Bloomfield, N. J.

New drying lamp will supplement the previously announced 250-, 500- and 1,000-watt drying lamps. Unlike the 250-watt R-40 bulb lamp, it does not incorporate a self-contained reflector, but must be used with a separate reflector preferably of Alzak aluminum or gold-plated metal.

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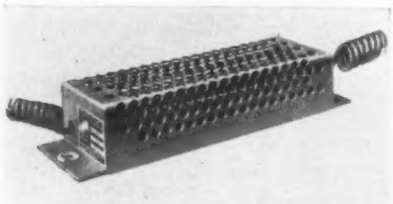
Resistor

New resistor is for use with 6-watt T-5 fluorescent lamp on either alternating or



Type "K-40878" fluorescent lamp resistor; approximately 1¾ x 6½ in. over all, insulated for 15,000 volts to ground. **Ward Leonard Electric Co.**, Mt. Vernon, N. Y.

direct current and has a manual momentary contact starting switch. It can be mounted in any standard fixture or wiring trough and eliminates the need of an auxiliary when lamp is operated on 120-volt circuit, it is claimed.

•

Resistance Bridge

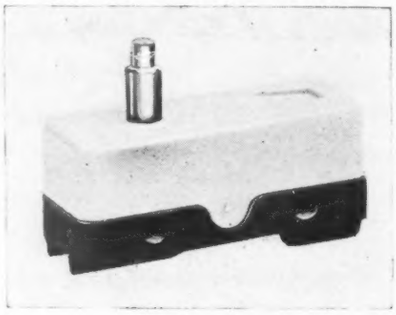
"No. 638-I" Kelvin-Wheatstone bridge; effective range from 0.0001 to 11 million ohms. **Shallcross Mfg. Co.**, Collingdale, Pa.

Resistance-measuring instrument has rheostat arm consisting of four decades, variable in 1-ohm increments. Ratio arm has two sets of multipliers. The set designated "W" is for use in Wheatstone bridge measuring. The other set, "K," is for use when measuring with the Kelvin bridge method. Built-in galvanometer has a deflection of 1 mm. per microampere.

•

Switch

Overtravel type is an addition to the company's line of switches which includes the principle of the rolling spring. Over-



"Acrosnap" overtravel type switch; capacity, a.c., 10 amp. 115 volts, 5 amp. 250 volts, 3 amp. 450 volts, maximum 1,000 watts; pressure 3 to 14 oz. **Acro Electric Co.**, 3158 Fulton Road, Cleveland, Ohio.

travel of at least $\frac{1}{16}$ in. is provided, though the amount of this used for actuation remains at 0.001 in. as in the standard pin plunger type.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Welding Timer

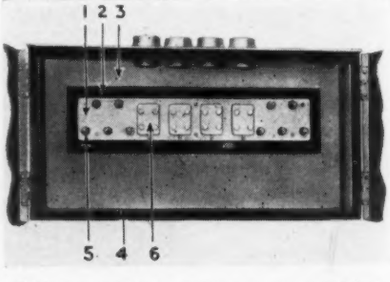
Combination welding timer consists of a control panel and ignitron tube assembly in a common inclosing cabinet. In operating, the electronic tubes and circuits are said to perform five distinct functions: "on" timing, "off" timing, pulsation counting, heat control, and firing of the ignitron power tube. Timer is especially adapted for seam and spot welding where frequent changes of timing are necessary.

Combination welding timer; seam weld "on" and "off" timing adjustment from 1 to 30 cycle steps; 1 to 15 pulsations for each setting. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

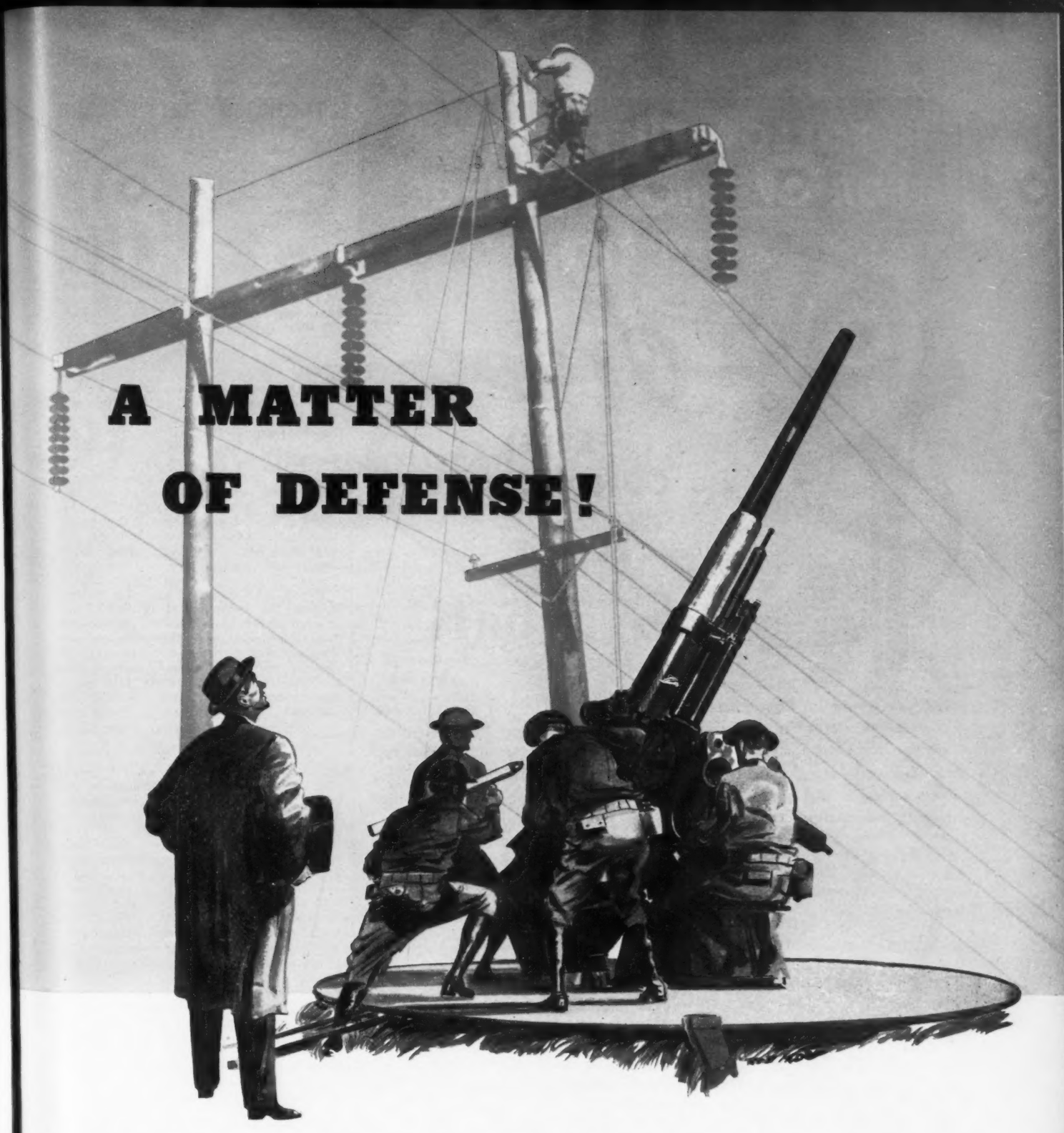
•

Panel

Welding terminal panel intercepts main welding feeders of constant potential system to provide facilities for welding leads. Panel (1) is a solid bronze casting mounted on an ebony asbestos block (2), which in turn is mounted in No. 10 gage galvanized iron box (3). Slots (4) in bottom of box provide entry for welding leads to be attached to terminal studs (5). Removable plates (6) provide means for tapping the main feeder.



Welding terminal panel. **O. Z. Electrical Mfg. Co.**, 262 Bond St., Brooklyn, N. Y.



Every mile of Pole Line that YOU build is a matter of defense effort. Every watt that flows through your conductors is a contributing factor toward the production of a bomber, a battleship or a field-piece.

These instruments of warfare cannot be produced without power—and power cannot be utilized without electrical transmission and distribution systems built to defy the naturally destructive elements of corrosion, electrical strain from lightning and mechanical strain from wind and sleet.

Whether it is a matter of defense or just good, plain, everyday customer service, it has to be RELIABLE. The engineer who specifies Hubbard Pole Line Hardware for his lines is giving his customers that quality which is an assurance of reliability.

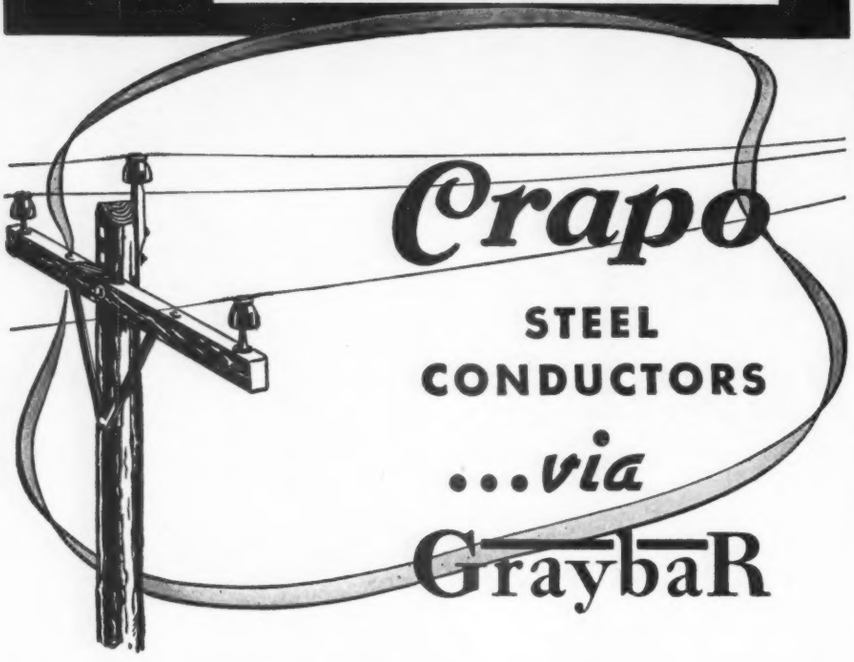
ANG THE DEFENSE LOAD ON HUBBARD HARDWARE!"

HUBBARD AND COMPANY

PITTSBURGH, PENNSYLVANIA
CHICAGO, ILLINOIS
OAKLAND, CALIF.

HUBBARD

FOLLOW THESE LINES FOR OVERHEAD SAVINGS



When you're out for *high efficiency* at *low cost*, that's the time to come to GRAYBAR for *Crapo* Steel Conductors. An unusual combination of high tensile strength and electrical conductivity cuts maintenance costs "to the bone." Then, too, red tape and annoying delays are kept to a minimum when you deal "via GRAYBAR." For economy and efficiency all along the line, for steel conductors or other pole-line needs, call on GRAYBAR.

Crapo HTC-130 Stranded (3-wire) Steel Conductors . . . Available in Nos. 4, 6 and 8 B.W.G. Stranded (3-wire). Permit longer spans with greater ground clearances, decrease service interruptions. Particularly suited to branch primary circuits supplying farm and residential service. Write GRAYBAR today for 10-page booklet containing engineering data on electrical and physical properties. Ask for Bulletin 107.

Crapo HTC Galvanized Steel Conductors . . . Ideal for rural distribution systems where individual load units are small and distances covered are relatively great. Quickly and easily installed. Bulletin 105, which gives the story from beginning to end, is yours for the asking. Write for your copy today.

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TECHNICAL LITERATURE

REPORT—"Report on General Principles for Rating of Electrical Apparatus for Short-time, Intermittent or Varying Duty" is a proposed supplement to Standards Pamphlet No. 1, "Introduction to A.I.E.E. Standards." In its final form the pamphlet is to serve as a guide in the preparation of standards for short-time rated or intermittent duty apparatus of specific types or fields of use. Copy of the publication, A.I.E.E. No. 1A, may be obtained from the American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.

BOILER AUXILIARIES—A report of the Boiler Auxiliaries Subcommittee of the Prime Movers Committee, Edison Electric Institute, contains data on operating and design problems related to boiler auxiliaries. Equipments listed are: forced and induced draft fans, hydraulic and magnetic couplings, dust collectors, ash and dust-handling equipment, breechings, chimneys, boiler feed pumps and control, and mill and drier vents. Publication No. I-4, "Boiler Auxiliaries, 1940-1941," may be obtained from Edison Electric Institute, 420 Lexington Ave., New York. Price $2 to non-members in U.S.A.

STEAM JET EJECTORS—A 32-page bulletin explains the theory and operation of ejectors and contains a discussion of single- and multi-stage ejectors. Other subjects covered are characteristics, facts affecting selection, and application. Curves giving air and water vapor mixture data and a pressure-temperature conversion table are included. The bulletin G-7, "Steam Jet Ejectors," may be obtained from Elliott Co., Jeannette, Pa.

PORTABLE ELECTRIC DRILLS—A Commercial Standard provides specifications for heavy-duty and standard rotary electric drills (exclusive of high frequency) in eleven standard sizes ranging from $\frac{3}{8}$ to $1\frac{1}{2}$ in. It covers design, construction, minimum full-load ampere rating for each class and size of drill, tests name plates, and a uniform method of certifying compliance with the standard. Commercial Standard CS93-41, "Portable Electric Tools," issued by the National Bureau of Standards, may be obtained from the Superintendent of Documents, Washington, D. C. Price, 5 cents.

PLANT DISTRIBUTION SYSTEM—Radial and secondary network distribution systems for use in industrial plants and power stations are described in a 77-page book, covering items from substations to switchgear. Typical applications and specifications for standardized units of equipment are given in detail. Assembly drawings show position of parts, give ratings and dimensions of principal items. Copy of book, B-2306, "Plant Distribution Systems," may be obtained from Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SLEEVE BEARINGS—An 11-section handbook discusses phenomena, fabrication, application, care and operation of sleeve bearings, is illustrated, and has considerable tabular data. It contains dimension sheets for conventional types of bearings and bushings in a wide range of sizes. "Handbook of Sleeve Bearings" is made available only to those engineers, designers and draftsmen who are directly concerned with sleeve bearing installations. Requests for copy should be sent to Federal-Mogul Corp., Shoemaker and Lillibridge Streets, Detroit, Mich.

MANUFACTURING-MARKETS

Production Requirements Plan Offers New Ratings

The new Production Requirements Priorities plan (ELECTRICAL WORLD, November 29, page 67), which becomes effective January 1, is a large scale expansion of the Defense Supplies Rating plan which it supersedes. Instead of being limited to manufacturers of "off-the-shelf" types of supplies, however, PRP is available to producers of all defense and essential civilian articles, including all items for utility operations.

Key feature of the plan is that it enables manufacturers to obtain one or more ratings which may be used continuously to obtain materials requirements for specified production over a three-month period at a time. Jobbers and wholesalers will continue to operate under the plan as they have been doing under the defense supplies program—that is, reporting to their manufacturers the proportion of their sales which are defense and non-defense.

PRP Applications

Application for ratings under PRP are made on form PD-25A, which is obtained by writing OPM's priorities division in Washington. Formal acceptance of the terms of the program must also be made by the manufacturer in submitting his first PD-25A form, which covers the January-March period of 1942.

Ratings granted a manufacturer may apply to all or part of his production, as OPM decides from the data supplied on the form. Different ratings may be granted for different portions of a single manufacturer's output. Data required from participating manufacturers include a complete description of products, a detailed outline of inventory in raw materials, work in progress, finished goods in stock and other supplies as of June 30, September 30 and the most recent check, dollar value and percentage of scheduled operations in the first quarter of 1942 classified both by preference ratings and by end use of products.

This analysis of production by both ratings and end use is designed to give OPM an opportunity to grant ratings to manufacturers turning out vitally needed supplies which may not have ratings. An example might be a hack saw producer whose output possibly carries few priorities ratings, but whose product—metal cutting tools—is needed in many types of essential work.

•

G.E. Gets Contract for Boulder Plant

Another giant generator will be added to bring to more than a million kilowatts the capacity of the Boulder Dam power plant, Secretary of the Interior Harold L. Ickes has announced.

General Electric Co. of Denver, Colo., will furnish and install the generator on its bid of $744,500. The company is required to complete the installation within 650 days. This new generator, designated as N-7, is to be of the same size as the six 82,500-kw. generators already operating in the Nevada wing and the three in operation in the Arizona wing. A smaller generator of 40,000 kw. capacity is also operating in the Arizona wing of the plant. Two station or house units add 4,800 to bring to 787,300 kw. the total capacity of the plant today.

Installation of two more of the huge units, A-2 and A-5, is being rushed, one for operation about the first of the year and the other for operation in July, 1942. With N-7 in operation by 1944 the capacity of the plant will reach a total of 1,034,800 kw.

•

Huge Transformer Business Reported

Transformer division of the Westinghouse Electric & Manufacturing Co. in East Pittsburgh, Pa., entered the final quarter of 1941 with a $15,000,000 backlog, biggest in its history and 430 percent over the $3,500,000 figure for the corresponding period of 1940, H. V. Putman, division manager, has recently reported.

Orders booked for the first nine months of this year showed an increase of 214 percent over the corresponding period for last year, while net sales billed in the first three quarters jumped 162 percent over 1940, Mr. Putman said.

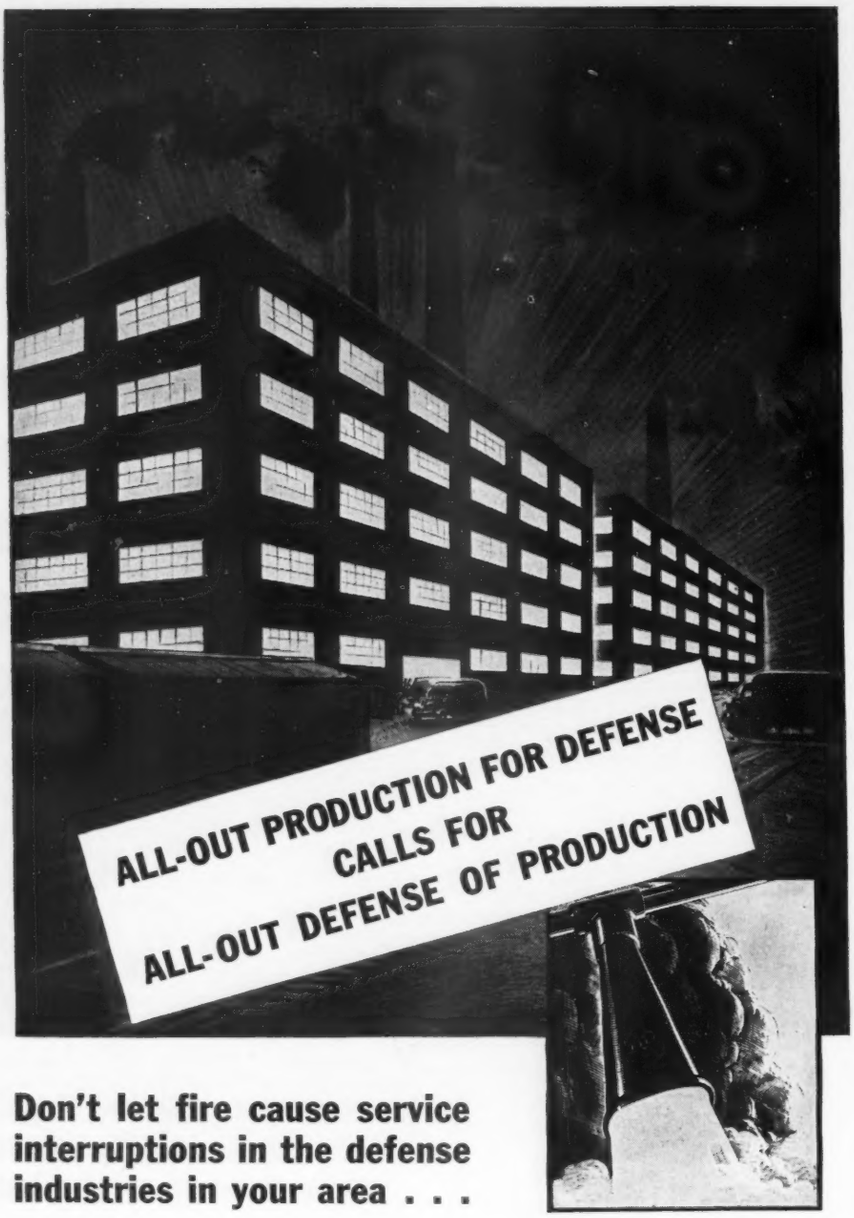
Incomplete figures indicated an even higher business curve for the transformer division for the remainder of 1941.

•

Westinghouse Plant to Rehire Workers

Westinghouse Electric & Manufacturing Co. has announced plans for rehiring workers in the company's plant at Mansfield, Ohio, in a defense-work program which will be in full swing next May. Government defense contracts at the plant eventually will provide jobs for 1,000 workers who had been laid off in recent months because of curtailed production of civilian goods.

"Our effort since last spring," said B. W. Clark, vice-president, "has been to solicit defense orders on a basis that would enable the workers released by curtailment of regular products to be absorbed in defense work without loss



Don't let fire cause service interruptions in the defense industries in your area . . .

AMERICA HAS A JOB . . . to keep production rolling. Your part of that job is to keep delivering power—*uninterruptedly.*

One fire in a vital machine, at a vital time, can throw many factories in a single area completely out of gear. Central station and sub-station alike need carefully planned fire protection . . . ready to kill fire promptly . . . cut outage to a minimum . . . reduce damage to rock bottom.

You get these results with built-in LUX extinguishing systems. LUX strikes back at fire with split-second speed. Harmless LUX carbon dioxide gas kills fire instantly, without damaging equipment, windings or insulation. *LUX helps confine fire damage to point-of-rupture.*

When the slogan is "Speed! . . . and more speed!" the quick, heavy fire-fighting punch of LUX is essential. LUX can help you deliver power for defense . . . *power without interruption.*

LUX SNUFFS OUT FIRE

Walter Kidde & Company
Incorporated
1228 West Street, Bloomfield, N. J.

of time. This goal has not been reached in the Mansfield plant, but excellent progress has been made."

•

Largest Fluorescent Installation Starts

The largest single fluorescent lamp lighting installation in the history of the industry in the new $47,000,000 Ford bomber plant near Ypsilanti, Mich., was announced this week by W. E. Poor, executive vice-president of the Hygrade Sylvania Corp.

Installation is now under way, Mr. Poor said. Approximately 156,000 Hygrade fluorescent lamps are being installed. Twelve fully loaded freight cars are required to carry the fluorescent lamps necessary for the installation in the Ford plant.

•

Brown, Boveri Celebrates

On October 2 Brown, Boveri & Co., Ltd., of Baden, Switzerland, completed the first half century of its existence. Charles E. L. Brown, son of an English mechanical engineer, who had settled in Switzerland in 1851, and Walter Boveri, a young mechanical engineer, planned the formation of the company. The firm was incorporated in 1891 and started actual production at the beginning of February, 1892, with a staff of 120 employees. During the first decade the firm participated in the rapidly growing demand for electrical machinery in all the industrial countries of Europe, increasing its staff to 1,800 men. Before the outbreak of the present war in Europe the Brown Boveri organization included 37 separate factories in sixteen different countries.

•

G.E. Expands Wire Systems

To help speed the handling of defense contracts, the General Electric Co. has added 3,796 miles to its private wire communication system since the first of the year. This brings the total of the network to 11,565 miles.

New York Metal Prices

	Dec. 9,'41 Cents per Pound	Dec. 3,'41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spot	8.64	8.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	15.00	15.00

*Delivery Connecticut Valley.

LET THE BUYER BE *Careful!*

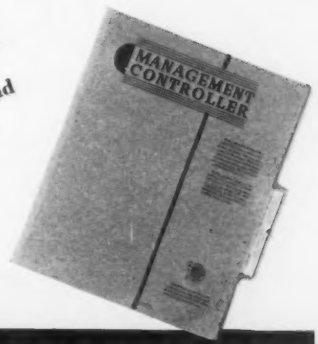
PREFERENCE RATING ORDER P-46 (pertaining to Maintenance, Repair and Supplies) contains this weighty ruling: *"Each producer (utility) shall maintain a continuing inventory of material included in stores accounts."* In addition: *"Each Producer (utility) who applies the preference rating . . . shall submit from time to time to an (inventory) audit and inspection by . . . the Office of Production Management."*

In other words, it's up to you to prove, at all times, you have complied with the numerous strict stipulations and regulations governing your acquisition of essential maintenance, repair and supplies stores. The penalties for even unintentional breaches are severe . . . *you can't afford to take chances!*

A KARDEX Visible System of Continuing Inventory Control plus correlative Remington Rand systems (procurable under P-46 with the A-10 rating) will be your best bet to stay within the variables of this ruling. Many utilities have already adopted Kardex systems and are enjoying amazing relief from the previous herculean task of coordinating the vast amount of paper-work demanded by "shooting war" times.

Why not get in touch with Remington Rand at Buffalo, or our nearest branch office? Ask to see the Utilities Division Representative. He can place in your hands tried and experience-proven methods. They will help you comply implicitly with P-46. They will save you a great deal of executive and clerical time in preparing required reports and analyses. They will cut your expenses and headaches.

The Utility buyer today must be "careful"! And Remington Rand is ready and able to help you!



The coupon at the right will bring you a new, fully illustrated Management Controller which clearly and simply explains *Inventory*, *Purchasing* and *Pricing* records that meet today's needs.

SEND COUPON TODAY!

Remington Rand Inc.
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☐ Send at once, without cost or obligation, **Management Controller** No. 637.

☐ Send a Utilities Division Representative.

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Utility .....

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REMINGTON RAND INC.

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Branches in all Principal Cities

SOMETHING BIG HERE *for* ELECTRICAL MEN

Looks like something in heating, ventilating and air conditioning. It is—it's typical of scenes you can see at the 7th International Heating and Ventilating—the Air Conditioning—Exposition.

The entire electrical industry has an important stake in these fields. They present rich opportunities for all who sell electrical energy or have an interest in applications for motors, control equipment, wiring devices and many another important item of interest to electrical men. In the heating, ventilating and air conditioning industries, marked changes have taken place. Never before was there so much to be learnd quickly, never such need to revise ideas, never a greater opportunity to apply knowledge with profit to the Nation and self at the same time. There is opportunity for every progressive man of the electrical industry right now.

How well equipped are you to help solve these problems of the day? A visit to this Exposition will show you where you stand, bring you up to date, enable you to act with the certainty of knowledge extended and confirmed. Plan definitely to attend this Exposition—with your associates.

803-A

Field Reports on Business

Industry is preparing for a considerable tightening of control of materials, production and prices, together with a speedy expansion of the armed forces as a result of the outbreak of war. In the face of the crisis stocks retreated.

NEW ENGLAND

Connecticut orders from the U. S. Government were the outstanding feature of interest in last week's business trend in this area. Pratt & Whitney Division, United Aircraft, East Hartford, received a $17,509,182 engine order; Luders Marine Construction Co., Stamford, was awarded an order for patrol vessels amounting to $2,563,400; Maxim Silencer Co., Hartford, received an order for equipment totaling $132,000, and Yale & Towne Mfg. Co., Stamford, pumps and motors, $487,734.

Twenty industrial customers of United Illuminating Co., New Haven, Conn., have added 4,200 kva. in load this year in association with capacitor installations. Power-factor correction is very active in the state. In a bill now pending before Congress for appropriations for enlarging airports and increasing their number, New England is allocated $3,235,210, which would involve an encouraging amount of electrical supplies for field lighting.

DFC has authorized a grant of $405,000 to John Bath & Co., Worcester, Mass., for machinery to be used in manufacture of ordnance equipment. Wire and cable orders are increasing; Simplex Wire & Cable Co., Cambridge, Mass., has been awarded a $178,230 order. Two Boston apartment houses with 31 suites have ordered 329 kw. in electric ranges, refrigerators and other equipment.

Christmas lighting among municipalities is moving ahead very fast and a number of private institutions are planning special effects. St. Francis' Seminary, West Andover, Mass., will use 13,000 lamps for decoration this year. Department stores report an active interest in electrical appliances and wiring effects for special illumination. Vermont appliance sales to date reported by one group of central stations establish record volumes in refrigerators, ranges and water heaters for several years back.

PACIFIC COAST

The Army is to survey 717 small manufacturing plants in the seven Western states to appraise their ability to handle contracts for small parts. California increase in both retail sales and farming income for this year over last is estimated at 20 percent.

Prices on staple lines are now steadier than for several months. Electrical holiday merchandise stocks are decidedly spotty and liberal substitution of makes and styles is only a partial remedy. Portable electrical heaters were sold out during November cold spell and manufacturers are a week behind orders.

New camps, fields and bases include $6,500,000 for Army Air Corps at Roswell, N. M.; $3,250,000 for 6,000 additional men at Camp Haan, Riverside, Calif.; a $12,000,000 bombing base near Reno; $2,000,000 additional for Camp Callen, near San Diego; $2,000,000 for light cruiser base at Morro Bay, on central Californian coast, and an additional $60,000,000 contract for enlarging Hawaiian Island and South Pacific naval bases. An Air Corps supply depot costing $20,000,000 is projected for San Bernardino County in southeastern California.

Manufacturers report exceptionally heavy shipments of switchgear equipment overseas for defense construction, typical underground fuel storage installations requiring $50,000 of such material for Pearl Harbor and Guam. Other interesting orders cover a $2,800 dynamometer, a $30,000 newspaper press main drive installation; police radio equipment costing $35,000 for Oakland; two electric locomotives, value $120,000, for a Nevada copper mine, and $135,000 of Diesel electric switching locomotives for various yards of Southern Pacific Co.

NEW YORK

Industrial output continues in exceptionally high volume, with the backlog of orders still huge. As a result of the war with Japan increasing emphasis will now be placed both in government and industry on the job of expanding defense production within existing plants as well as in building new plants. The beginning of the holiday season found general business activity in record volume.

While unfavorable weather conditions retarded expansion of the Christmas trade in the metropolitan area, estimates indicated an average gain for department stores of between 3 and 5 percent over the corresponding week last year.

Engineering construction awards for the four weeks of November totaled $348,800,000, according to *Engineering News-Record*. This is an average of $87,200,000 per week and is 7 percent higher than the average for the five weeks of October, but 9 percent lower than the average for the four weeks of the corresponding 1940 month.

CHICAGO

With the nation now at war Army and Navy officials will move for an immediate doubling of the production of armament materials. Impact of this program will likely find greatest reflection on Middle West industries, inasmuch as defense industries along the seacoasts are nearer to capacity than is the case in this area.

Of 29 manufacturers reporting November sales of electrical equipment to the Electric Association, sixteen showed decreases from October, while 23 had gains over November, 1940. Fifty percent of the electrical wholesalers reported increases over October and 100 percent had gains over November last year. Electrical truck sales reached an all-time high in October with 513 units, compared with 494 in September and 193 in October, 1940.

General Electric Company will erect a $25,000,000 turbo-generator plant at Fort Wayne, Ind. During November new plant expansion programs involving a total expenditure of $86,246,166 were started in the Chicago area.

Defense contracts totaling $9,951,000 were awarded to 89 firms here last week, including electrical equipment for Pyle-National Co., floodlights, $88,490; Simpson Electric Co., voltmeters, $30,000; Janette Manufacturing Co., rotary converters, $8,740; Automatic Transportation Co., electric trucks, $66,960; Nehring Electrical Works, conductors, $10,858.

Defense Savings Pay-Roll Allotment Plan

How company heads can help their country, their employees, and themselves

voluntary pay-roll allotment plan	helps workers provide for the future
	helps build future buying power
	helps defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something *now* to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a *systematic* and *continuous* Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, *willingly*.

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his *own* house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done *of its own free will*.

In emergencies, America doesn't do things "hit-or-miss." We would get there *eventually* if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to *systematize* the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up

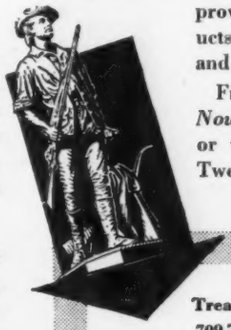
No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is *your* plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all *you* have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

The first step is to take a closer look. Sending in the coupon in no way obligates you to install the Plan. It will simply give you a chance to scrutinize the available material and see what other companies are already doing. It will bring you samples of literature explaining the benefits to employees and describing the various denominations of Defense Savings Bonds that can be purchased through the Plan.

Sending the coupon does nothing more than signify that you are anxious to do *something* to help keep your people off relief when defense production sloughs off; *something* to enable *all* wage earners to participate in financing Defense; *something* to provide tomorrow's buying power for your products; *something* to get money *right now* for guns and tanks and planes and ships.



France left it to "hit-or-miss" . . . and *missed*. *Now* is the time for *you* to act! Mail the coupon or write Treasury Department, Section A, 709 Twelfth St. NW., Washington, D. C.

FREE - NO OBLIGATION

Treasury Department, Section A,
709 Twelfth St. NW., Washington, D. C.

Please send me the free kit of material being used by companies that have installed the Voluntary Defense Savings Pay-Roll Allotment Plan.

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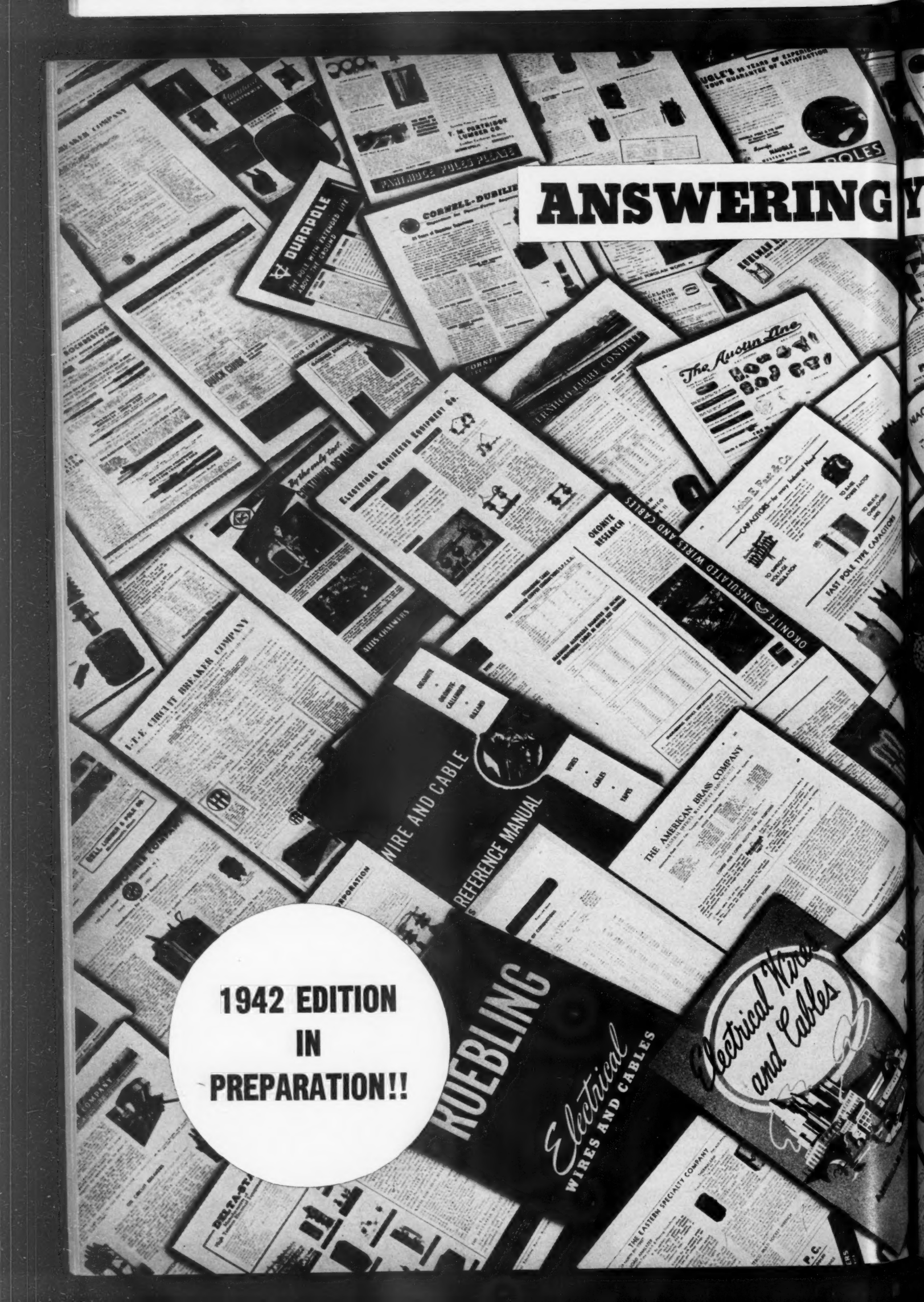
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WIRE AND CABLE
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YOUR T&D QUESTIONS

When you're buying or specifying transmission and distribution equipment, make Electrical Buyers Reference your *first* source of information.

Because—bound into this *one* volume are the condensed catalogs of 49 leading manufacturers of high voltage equipment . . . over 90 pages of specifications on their products, addresses of sales representatives, technical data, and so on.

Check over the list of these "T & D" manufacturers who are cataloging their products in the 1941 Electrical Buyers Reference. . . .

How many of the catalogs of these companies can you find *quickly*? How many of them would you keep on your desk, in one compact volume?

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American Brass Co.
American Steel & Wire Co.
American Transformer Co.
Austin Co., M. B.
Bell Lumber & Pole Co.
Brown Co.
Clover Co., F. G.
Cope, Inc., T. J.
Cornell-Dubilier Electric Corp
Delta-Star Electric Co.
Eastern Specialty Co.
Electric Power Construction, Inc.
Electric Power Equipment Corp.
Electric Service Supplies Co.
Electrical Engineers Equipment Co.
Erie Electric Co.
Fast & Co., John E.
Fibre Conduit Co.
Gardner Electric Mfg. Co.
General Electric Co.
Illinois Electric Porcelain Co.
Imperial Porcelain Works, Inc.
I-T-E Circuit Breaker Co.
Johns-Manville Corp.
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Moloney Electric Co.
M & W Electric Mfg. Co.
National Pole & Treating Co.
Naugle Pole & Tie Corp.
Okonite Co.
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Pennsylvania Transformer Co.
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Rockbestos Products Corp.
Roebling's Sons Co., John A.
Roller-Smith Co.
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United States Rubber Co.
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Westinghouse Electric & Mfg. Co.

This is just what Electrical Buyers Reference does: it puts your buying and specifying information at your fingertips, ready for instant service on today's rush jobs.

★ ★ ★

"T & D" equipment is but part of the Electrical Buyers Reference story. Only 49 companies are listed above . . . *189* other manufacturers have condensed catalogs in this reference volume . . . 338 pages of specifications and product data!

In addition, Electrical Buyers Reference provides you with a complete, product classified listing of 3500 manufacturers of electrical and allied products. Flip to the product, and you'll find the names and addresses of all known manufacturers of this product! Another index identifies trade names . . . and of course, there's a full cross-index of product classifications.

This is the kind of buying and specifying information you need . . . "who makes it" questions answered at the flip of a page. A closet-full of catalogs boiled down into one neat, serviceable volume! That's why we say, Use Your Electrical Buyers Reference . . . it saves time and boosts efficiency!

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 West 42nd Street, New York, N. Y.

NEWS ABOUT PEOPLE

Graybar Electric Elects A. H. Nicoll President

Announcement has been made by the Graybar Electric Co. of the election of A. H. Nicoll as president and of G. F. Hessler, D. H. O'Brien and E. W. Cashman as vice-presidents. F. A. Ketcham, present president, becomes chairman of the board.

Mr. Nicoll reaches the presidency after 30 years of service with the company, starting as a sales record clerk in San Francisco. He spent six years in the Salt Lake City office, but returned to San Francisco in 1920 and was appointed manager in 1932. The electrical industry on the coast is familiar with his ability. While on the Pacific Coast he actively participated in all phases of industry work. In 1927 he was president of the San Francisco Electrical League and in later years headed up various committees in the Pacific Coast Electrical Association. He was also active in the Pacific Division of the National Electric Wholesalers' Association, serving in 1933 as its chairman. In 1939 Mr. Nicoll came East as assistant to the president of the company and last year was elected vice-president.

Mr. Hessler started with Graybar in 1906 in the purchase records department. By 1919 he had become manager of the line material department. In 1926 he became general utilities sales manager and in 1933 received the appointment of assistant general sales manager.

A native of Cork, Ireland, Mr. O'Brien came to this country in 1907 and began his career with the Western Electric Co. in 1916, when he started as supply salesman. He worked up through various positions to manager of lighting department and manager of telephone and radio departments at the New York house. In 1928 Mr. O'Brien was transferred to the general department as radio sales manager and the following year became general merchandising manager. In 1934 he was appointed head of the general merchandising department.

Mr. Cashman started with the company in the accounting department at Minneapolis. Advancing steadily through service work, he was appointed service manager in 1921. Subsequently he served as service manager in Philadelphia, Chicago and then in New York. In 1939 he was promoted to the position of general service manager with headquarters in New York.

1 A. H. Nicoll

2 G. F. Hessler

3 D. H. O'Brien

4 E. W. Cashman

PUBLISHER—William K. Beard, Jr., manager of "Electrical World" since 1935 and of *Electrical Contracting* since 1940, has been appointed publisher of those papers. A graduate of the Wharton School of Commerce and Finance of the University of Pennsylvania, Mr. Beard has been associated with the McGraw-Hill Publishing Co. since 1924

J. V. Toner New President of Boston Edison

James V. Toner, executive vice-president of the Boston Edison Co. since 1938, has been elected president of that utility, succeeding the late Frank D. Comerford. Mr. Toner had been a close friend and business advisor of Mr. Comerford for many years. He became associated with the Boston company in April, 1937, when he was elected auditor. A month later he was named assistant treasurer, and in June, 1937, succeeded Thomas K. Cummins as treasurer upon the death of Mr. Cummins. In September of that year, following the resignation of Sidney Hosmer as vice-president and director, Mr. Toner was elected vice-president,

ORANGEBURG HAS BEEN A LASTING NAME "UNDERGROUND" FOR 48 LONG YEARS

Buried in salt marshy ground below tide-water . . . in corrosive cinder and refuse backfill . . .

ORANGEBURG CONDUITS

are contributing to an uninterrupted flow of power from central stations to the motors of industry

ORANGEBURG *Standard* for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

Photograph by Galloway

Build for tomorrow with

ORANGEBURG *Conduits*

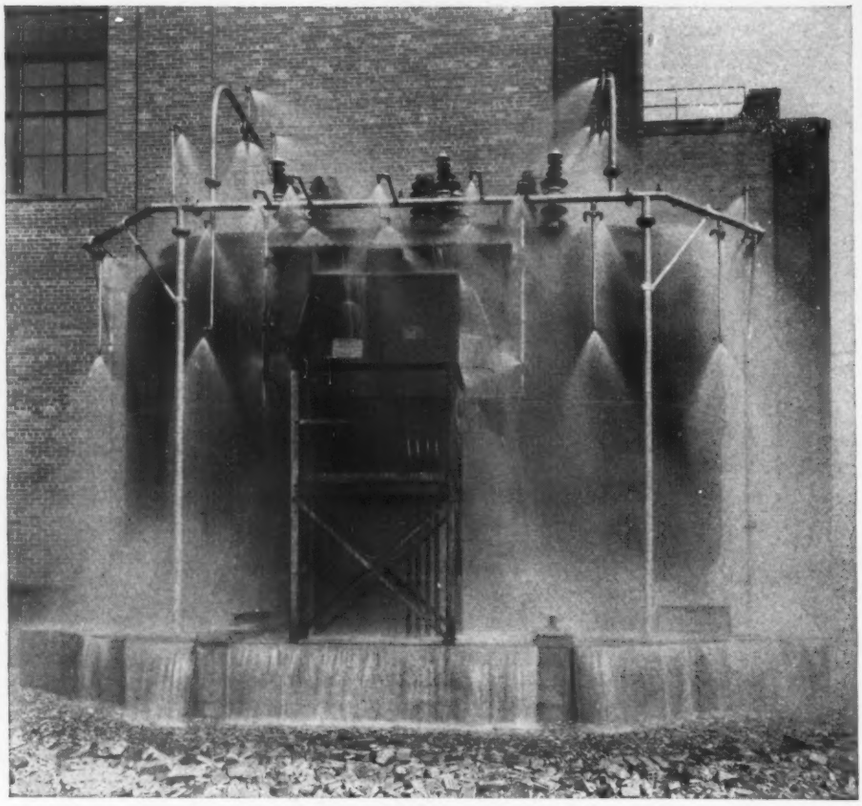
MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

Sales Agent—Distributors

GENERAL ELECTRIC SUPPLY CORP. GRAYBAR ELECTRIC CO., INC.

12-FC-1

Not only extinguishes fire but prevents re-ignition

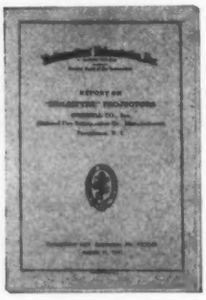


Unique Grinnell Mulsifyre System creates a Non-flammable Oil Surface

With driving sprays of water alone, a Grinnell Mulsifyre System on your oil-filled equipment will smother fire in 2 to 5 seconds . . . and prevent re-ignition.

Grinnell Mulsifyre Systems are fixed equipment . . . operated either manually or automatically. They operate on the positive principle of emulsifying the oil. After 5 hours, complete separation of water and oil leaves oil undamaged.

Investigate this fast, positive way to end your oil-fire hazards. Used by leading utility companies the world over. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities.



WRITE FOR this 76-page booklet by Underwriters' Laboratories explaining Grinnell Mulsifyre Systems in detail.

GRINNELL

Automatic Sprinkler Fire Protection

director and member of the executive committee, continuing to serve as treasurer. In October, 1938, he became executive vice-president. In his association with the late president, Mr. Toner has played a leading part in the organizational changes which have taken place in the company, in its financing problems, and in the expansion of its generating transmission and distribution facilities.

Mr. Toner is a native of North Attleboro, Mass., and was educated at Holy Cross College and Boston University, qualifying as a certified public accountant in 1921. His earlier career includes teaching business subjects at Boston University, the establishment of the School of Business Administration at the University of Porto Rico, and leadership in the manufacturing jewelry business, where he served as president of the New England Manufacturing Jewelers & Silversmiths Association.

•

▶ DR. WILLIAM R. HAINSWORTH, vice-president in charge of engineering of Servel, Inc., was elected president of the American Society of Refrigerating Engineers at the annual meeting held recently in St. Louis. Dr. Hainsworth, who succeeds L. L. Lewis, vice-president of the Carrier Corp., has been engaged in refrigeration research for more than twenty years.

▶ CHARLES H. GODDARD, general sales manager of the Pittsburgh Reflector Co., Pittsburgh, Pa., for the past year, has been appointed vice-president and director of sales. Mr. Goddard has moved his headquarters from New York City to the general office at Pittsburgh. Much of his time will be spent in the various sales territories throughout the United States. Mr. Goddard has been identified with the lighting industry for many years and has been connected with Pittsburgh Reflector Co. since

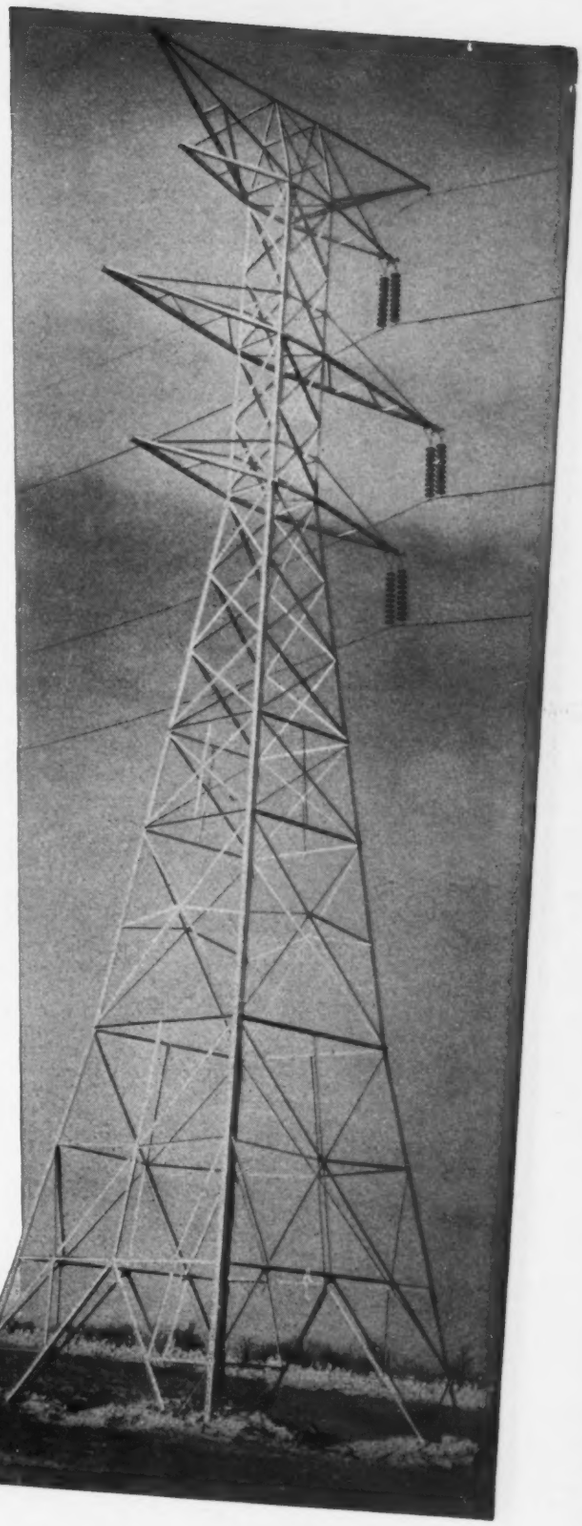
Towers for Power *by* Tower Specialists

Showing a recent and new design which combines graceful appearance with economy in construction

IT has been 36 years since the first towers for transmission lines were designed and constructed by American Bridge Company. Today, the towers they conceived dot every imaginable kind of terrain, not only over this broad land, but over many others. This is the growth of a specialty whose experts have shown rare facility to meet every kind of changing condition and need created by the rapidly increasing demand for electric power transmission.

The tower illustrated is a case in point. Two major desires dictated its design—pleasing appearance and economical construction. Both were accomplished with every consideration for efficiency.

Experience, facilities and highly specialized engineering are the prime requisites for tower planning. American Bridge Company offers them all. Out of its research have come many patented features which contribute to more effective and economical construction. In addition to a complete plant, ample in capacity and devoted entirely to the fabrication and galvanizing of all types of transmission towers, it has the largest and most modern Test Frame in the country for testing even the tallest line towers in present use. Whatever your requirements may be, these resources are at your service.



BUILT TO CARRY *132 K.V. double-circuit, inter-connection lines in Ohio and Indiana, this American Bridge Company design incorporates many up-to-date features, such as a flaring base, greater height of ground wires, horizontally staggered alignment of conductors to provide effective cable clearances under sleet conditions, and standard American Bridge earth footings.*

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit
Duluth · Minneapolis · New York · Philadelphia · St. Louis

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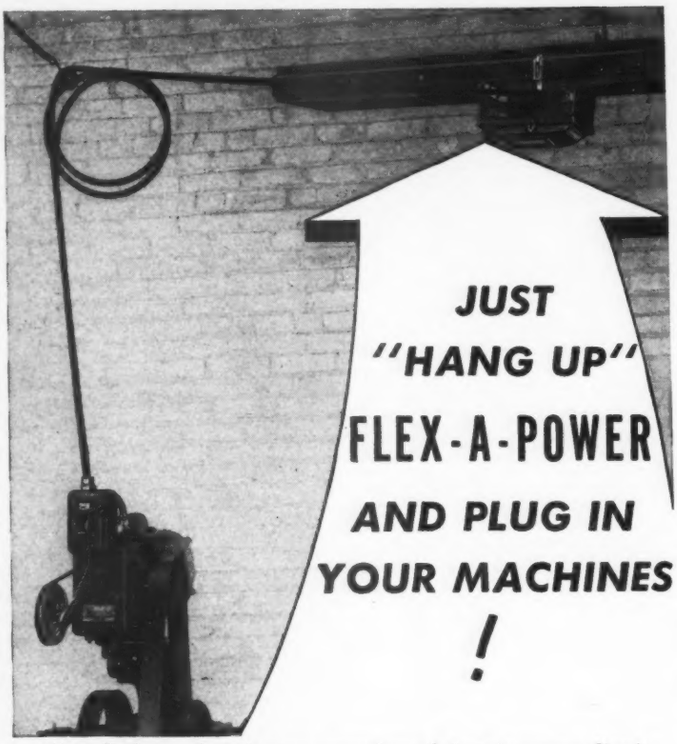
United States Steel Export Company, New York

UNITED STATES STEEL

TRUMBULL

QUICK RELIEF FOR "GROWING PAINS"

IN DEFENSE PLANTS



Installation, relocation or extension of electric power distribution to meet changing needs can be just that simple . . . with FLEX-A-POWER, since Trumbull pioneered this startling development in 1927 we have continually improved its efficiency and utility.

Flex-A-Power is, in effect, a modern panelboard "running the length of the plant", and it comes to you all ready to hang up and connect. Machines "plug in" at any desired point along the line with FLEX-A-PLUGS that are self-contained switching and protective devices. Relocation or addition of machine units is a matter of minutes, and the whole system is SALVABLE when future changes become necessary.

Available in sizes and capacities for both large and small load requirements. Do no more plant wiring till you have full information on this newer, better way. Ask for Circular 328.

- 250-600 V. A.C.
- 125-1000 Amp

ESTABLISHED 1899
THE TRUMBULL ELEC. MFG. CO.
PLAINVILLE CONN. U.S.A.
A GENERAL ELECTRIC ORGANIZATION

KEEP *Alert* ELECTRICALLY
use your TRUMBULLAIDS

NEW YORK - PHILADELPHIA - BOSTON - CHICAGO - DETROIT - NORWOOD, O. - ATLANTA - NASHVILLE - LOS ANGELES - SAN FRANCISCO - SEATTLE

1931. He has served on numerous committees of the Illuminating Engineering Society and has been chairman of the lighting fixture manufacturers committee of the Electric and Gas Association of New York.

▶ P. L. G. HASSKARL, of the Pennsylvania Power & Light Co., Allentown, Pa., was elected general chairman of the public utilities section of the National Safety Council at the recent meeting in Chicago.

▶ B. R. CHESTNEY, vice-president of the Georgia Power Co., and manager of the Macon division, has been selected to head a utilities group which will serve as a subcommittee of the Macon Civilian Defense Council.

▶ W. R. FREEMAN has been appointed sales manager of the Wabash Appliance Corp., Brooklyn, N. Y., and its subsidiary, Birdseye Electric Corp. Mr. Freeman will direct sales of all Wabash incandescent and Birdseye reflector lamps. He was formerly assistant general sales manager of Manning, Bowman & Co., Meriden, Conn.

▶ HERBERT H. BENFIELD, formerly sales manager of the steel tubes division of the Republic Steel Co., has been appointed New York district manager of the Bull Dog Electric Products Co. A native of Cleveland, Mr. Benfield has engaged in promoting the use, application and marketing of thin wall conduit. Following his initial sales training and work in the East, he spent a number of years on the West Coast before his appointment as executive sales head of the steel tubes division for Republic Steel.

▶ BRUCE R. PRENTICE, who has been connected with the aeronautics division of the aeronautics and marine engineering department of General Electric Co., has been promoted to the position of engineer, aeronautics equipment division. KENNETH K. BOWMAN has been named assistant engineer, aeronautics equipment division. HARLEY H. BIXLER has been appointed mechanical engineer on special assignments and LAURENCE R. LEVEEN administrative assistant in the ordnance control division. Mr. Bowman became associated with the aeronautics division of the aeronautics and marine engineering department this year. He received the Charles A. Coffin Foundation award in 1939, in collaboration with two other General Electric engineers, for developing a system of amplification and automatic control. Mr. Bixler has been identified with the G.E. organization since 1926. Mr. Leveen became associated with General Electric in 1929 and has been designing engineer of the wire department for the past three years. He is active in committee work of the American Welding Society.

Quick Facts on
TRANSITE DUCTS

Two types of Transite Ducts are available—Transite CONDUIT and Transite KORDUCT. Both are made of asbestos and cement, by the same manufacturing methods. The basic difference lies in the wall thickness, that of the CONDUIT being greater than that of the KORDUCT.

BOTH TRANSITE CONDUIT AND TRANSITE KORDUCT HAVE THESE CHARACTERISTICS IN COMMON—

1. ***Incombustible***—Because they are made of asbestos and cement, Transite Ducts cannot burn, will never contribute to the formation of dangerous smoke, fumes or gases. When burnouts occur, systems are safer, for damage to adjacent cables and equipment is minimized.
2. ***Immune to Electrolysis***—Inorganic and nonmetallic, Transite Ducts can never be affected by electrolytic action.
3. ***Unusually Smooth Bore***—Cable pulls and replacements are easier, damage to cable sheathing is virtually eliminated.
4. ***Easily Installed***—The long lengths, light weight and easily assembled couplings of Transite Ducts make lining up rapid and economical.

TRANSITE CONDUIT

For use without a concrete envelope, both underground and in exposed locations—J-M Transite Conduit—

1. Makes important savings in labor and material costs by eliminating "concreting in."
2. Maintains full strength and true form under sustained earth loads and traffic pressure.
3. Cannot rust or rot—is highly resistant to all forms of soil corrosion, virtually unaffected by weather, smoke and fumes.
4. Low in cost—much more economical than other materials of comparable strength and corrosion-resistance.

TRANSITE KORDUCT

For use where a concrete envelope is specified —J-M Transite Korduct.

1. Thinner walled, lower priced, otherwise identical with Transite Conduit.
2. Long lengths mean fewer joints, cut down the number of spacers required.
3. High rate of heat dissipation lowers cable operating temperatures—increases system capacity.
4. Copper (I^2R) losses are reduced to a minimum.

For complete engineering data and specifications on both Transite Conduit and Transite Korduct, write for technical data book, DS-410. Johns-Manville, 22 East 40th Street, New York, N.Y.

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete.

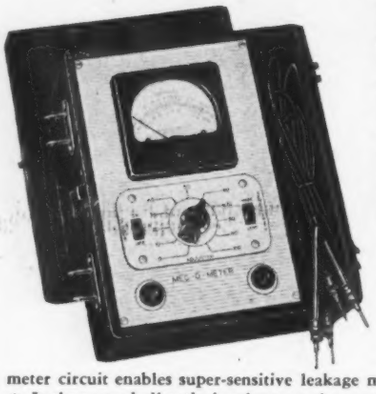
TRANSITE CONDUIT—for exposed work and for installation underground without concrete encasement.

THE MEG-O-METER

A New **INSULATION CHECKER**

MEASURES LEAKAGES UP TO—

100,000,000 OHMS (100 Megohms)



THE MEG-O-METER WILL ENABLE YOU TO INSTANTLY DETERMINE THE CONDITION OF THE INSULATION AND LESSEN THE POSSIBLE DANGER OF BREAK-DOWN IN—

Utility and Power Plants: Power distribution lines, carrier systems, transformers, power factor correction equipment, etc.

Industrial Plants: Motors, power cables, controllers, heaters, relays, condensers, control devices, transformers, inductances, furnaces, meters, elevators in fact everything electrical.

Homes: House wiring, washing machines, refrigerators, electrical ranges, etc.

SPECIFICATIONS:

• No hand cranking—no danger of high-voltage shock—the radically new design of this amazingly versatile instrument enables direct readings in a "jiffy." The MEG-O-METER which incorporates a recently perfected Vacuum-Tube Voltmeter circuit enables super-sensitive leakage measurements with standard self-contained batteries.

• Leakage read *directly* in ohms on the meter scale and *leakages indicating a dangerous condition are printed in red.*

• Unlike the transformer or "break-down" type of insulation tester where a potential is applied to the circuit to be tested, often creating the very condition originally suspected, the MEG-O-METER measures the leakage in ohms and may be used continuously to check *without weakening the insulation under test.*

• To use the MEG-O-METER simply connect the two leads to the circuit, appliance, motor or utility to be measured. Then throw the snap switch and read the leakage directly in ohms on the scale of the meter. That's all there is to it!

The Meg-O-Meter operates on self-contained batteries and *no external source of current is required.* Complete with batteries, test leads and instructions. Only..... **$12.85**

SUPERIOR INSTRUMENTS CO. DEPT E. W. 227 FULTON STREET NEW YORK, N. Y.

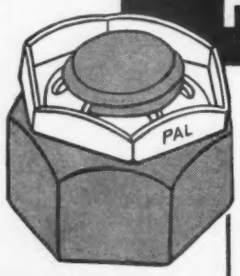
ON SUB-STATIONS, TOO—

KEEP STRUCTURES and FITTINGS TIGHT with

Give your sub-station steel structures, bus fittings and supports the same vibration-proof security that PALNUT Locknuts are providing on transmission towers, wood pole lines, transformers and other electrical equipment. PALNUTS are easily, speedily applied on top of regular nuts and locked tight with ⅓ turn of a wrench. Need but 2 full bolt threads. To obtain PALNUT reliability be sure to specify PALNUTS for all bolted connections. Write us for details and samples.

Standard on Aircraft Engines, Passenger cars and trucks

Double Locking PALNUTS



Double Locking Action

The Palnut is a single thread locknut, made of tempered spring steel. When tightened, its arched, slotted jaws grip the bolt like a chuck, while spring tension is exerted upward on the bolt thread and downward on the regular nut, securely locking both.

THE PALNUT COMPANY

Manufacturers of Locknuts and Self-Locking Nuts

51 CORDIER STREET IRVINGTON, N. J.

► WILLIAM E. SAWYER has been named to take charge of advertising, promotion and related activities of the General Electric Home Bureau, Bridgeport, Conn. Mr. Sawyer, who has been associated with the advertising activities of the General Electric appliance and merchandise department for several years, takes over duties formerly performed by F. A. Purnell and Paul E. Whitney, resigned.

► C. A. NORTON, who has been active in the electrical industry for more than 30 years, has recently joined the staff of Pierce Laboratory, Inc., New York, in the capacity of sales manager. Mr. Norton was associated with the Westinghouse Lamp Co. for many years. He is a member of the board of governors of the Electrical and Gas Association of New York.

► H. C. POWERS has been appointed by the Tell City, Ind., utility board as superintendent and chief engineer of the municipal electric light plant. Property of the Ohio River Power Co., an Associated unit, will be taken over by the city shortly after January 1. Citizens in a recent special election voted to buy the plant. Mr. Powers has been an employee of the Associated system for the past 21 years and has been with the Ohio River Power Co. for sixteen years.

► WALLACE W. LOCKWOOD has been appointed advertising manager of the Taylor Instrument Companies, Rochester, N. Y., to succeed **Elmer E. Way,** resigned. A graduate of Syracuse University, Mr. Lockwood joined the Taylor advertising department in 1932 and was made assistant advertising manager in 1939. He had previously been connected with the Lapp Insulator Co., Leroy, N. Y.; the Z. L. Potter Advertising Agency and the David Tynion Advertising Agency, both of Syracuse.

► E. M. COPELAND, JR., has been appointed manager of the Georgia Power Co. at Austell, succeeding G. W. Dickerson, who has joined the Rome district operating forces.

► HARVEY L. WILLIAMS, JR., has joined the Hawkins-Hamilton Co., Richmond, Va., as a sales engineer. A graduate of Washington and Lee University, Mr. Williams has for the past ten years been associated with A. M. Gathright & Co. in air-conditioning work. His responsibilities with the Hawkins-Hamilton Co. include sales engineering work in the Richmond territory for Cochrane Corp., Hays Corp., Nash Engineering, Northern Equipment, Terry Steam Turbine, Andale Co., Detroit Stoker Co., Micro-Westco, and Crosby Gauge & Valve.

OBITUARY

J. E. Lynch

J. E. Lynch, vice-president and general sales manager of the Minnesota Power & Light Co., Duluth, died on December 4, in that city.

Mr. Lynch had been identified with the Duluth properties since 1928, when he was appointed assistant general sales

manager. In 1931 he was made general sales manager and in 1936 he was elected vice-president of the company, continuing in charge of sales.

Earlier in his career Mr. Lynch was connected with Stone & Webster on the Keokuk Dam and also on the Hauser Lake Dam in Montana. Before affiliating himself with Minnesota Power & Light he was general manager of the Page & Hill Co., Minneapolis, producer and manufacturer of cedar poles.

Mr. Lynch was past-president of the North Central Electric Association.

•

Allan H. Jackson

Allan H. Jackson, vice-president and general counsel of the General Electric Co. until his retirement in 1929, dropped dead, of a heart attack, in Schenectady, N. Y., on December 7. He was 77 years of age. Mr. Jackson was born in Schenectady and was graduated from Union College in 1886 and two years later from the Albany Law School. After engaging in the practice of law in Schenectady and in New York he established his first contact with General Electric affairs in 1900. It was at this time that the National Electric Lamp Association was being organized at Cleveland. At the request of the late Hinsdill Parsons, at that time general counsel of the company, Mr. Jackson went to Cleveland and assisted in bringing about the formation of the national association. This work was a forerunner to his direct

BUILD BETTER CELL STRUCTURES —*FASTER*— with J-M Trancell. Made of asbestos and cement, Trancell comes in large, easily handled units that any handy man can install. Its light weight cuts down floor loading. Non-metallic, it ends condensation troubles. And because Trancell is fireproof, oil fires are confined to the cells of origin. Yet Trancell costs no more than other cell-structure materials. For details, write Johns-Manville, 22 East 40th Street, New York, N. Y.

TRANCELL INSTALLATION at Wisconsin Electric Power Co., Milwaukee. Cell structures of J-M Trancell are installed *dry*, in minimum time . . . never cause shutdowns for cleaning or painting. Trancell Doors offer equal advantages . . . virtually eliminate warpage.

JM

Johns-Manville TRANCELL

an asbestos product . . . for better cell structures and doors

PAGE FENCE

America's First Wire Fence — Since 1883

PROTECTION—ON THE LINE

★ The name PAGE not only identifies dependable property line protection but it is the symbol of quality that safeguards the investment. In Page Fence you get an assemblage of superior qualities, many of them exclusive. Page Winged Channel Posts are stronger and longer lasting. The semi-flat weave makes possible a taut fabric of maximum strength. All parts of the supporting structure are expertly designed and faultlessly made. And Page Fence is erected by technically-trained, long-experienced, responsible local business men. Write for "Fence Facts," to PAGE FENCE ASSOCIATION, Monessen, Pa., or Bridgeport, Conn., New York, Pittsburgh, Atlanta, Chicago, Denver, San Francisco.

A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.

NEW BOOK

Electric Distribution Fundamentals

SHOWS HOW TO SOLVE

the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution

From a non-engineering viewpoint, this book outlines features of both utility distribution and the industrial and inside wiring branches of service to the outlet.

THE ABC OF ELECTRIC DISTRIBUTION

Tells how the distribution system is designed and built, how it works, and how it is serviced and operated; explains equipment and its use, design of carrying lines, problems of maintaining flow, and materials; discusses how distribution fits in economically with the general system of electric supply; covers voltage drop, wire size calculation, power factor, etc., etc. Practical design problems are included with solutions based on diagrams instead of difficult mathematics.

Look at these Headings

- Perspective of the Electric System
- Distribution to Serve the Load
- The Distribution Division
- Generation of Electricity
- Fundamentals of the Electric Circuit
- Inductance and Related Characteristics
- Tools for Electrical Problems
- Transformers
- Transformer Connections
- Voltage Control
- Current Interrupting Equipment
- Voltage Protection—Lightning—Grounding
- Street Lighting Circuits
- Mechanical Principles in Distribution
- Economic Principles in Distribution
- Measures of Service

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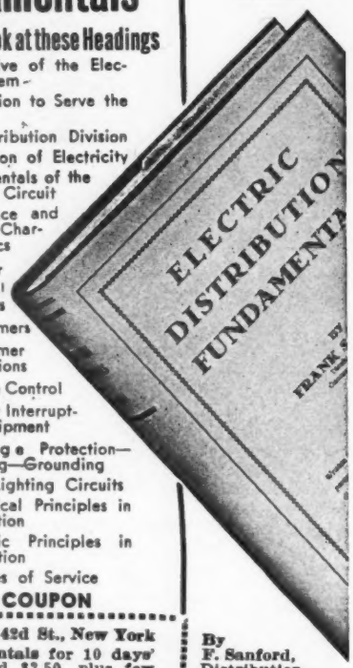

By F. Sanford, Distribution Engineer, Cincinnati Gas & Electric Co.

242 pages
156 illustrations
15 tables
1 chart

$2.50

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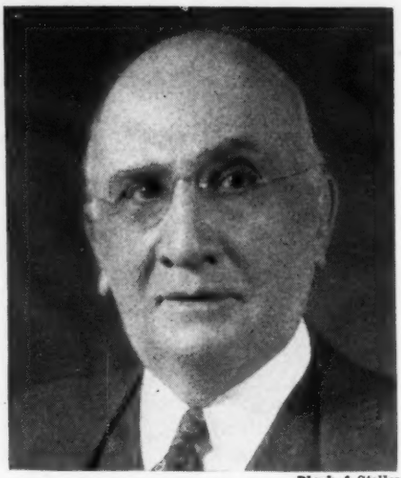
employment by General Electric in 1902 as one of its attorneys. Mr. Jackson became counsel to the company in 1911, and after Mr. Parson's death, in 1912, he became the head of the law department. In 1922 he was appointed vice-president and general counsel.

•

Julian Roe

Julian Roe, for many years western sales manager of the Crocker-Wheeler Electric Manufacturing Co., died at his home in Chicago on November 24. One of the early pioneers in the motor and generator field, Mr. Roe was a factor in the development of the use of electric power in the steel, automobile and printing industries.



Blank & Stoller

In 1894, one year after joining Crocker-Wheeler, Mr. Roe supervised at the Pencoyd Iron Works, later part of the American Bridge Co., the installation of the first electric control system for transfer roll tables ever to be used in a steel mill. In 1899 he was appointed Chicago district manager for Crocker-Wheeler, and in 1927 western sales manager.

For many years Mr. Roe was actively interested in the Electric Power Club and in the National Electrical Manufacturers Association during its early days. He was a member of the Association of Iron and Steel Engineers.

•

► GARRETT N. SCHWEMMER, representative of Line Material Co. in Washington, D. C., since 1925, died in that city on November 26, as the result of a heart attack. Mr. Schwemmer had been identified with the electrical industry since early manhood. Prior to joining the Line Material sales organization he was associated with the Carroll Electric Co. of Washington. Mr. Schwemmer was born in Philadelphia, Pa., 60 years ago.

Alabama Power Uses Fireless Locomotive

A fireless locomotive is being used for heavy hauling around the new Chickasaw steam plant of the Alabama Power Company. Instead of a boiler or firebox the locomotive has a large capacity storage tank. Steam from the main plant boilers is directed into this tank and heats the stored water to a predetermined temperature which also fixes the steam pressure in the tank above the water. As steam is drawn off in operation of the locomotive, this reduces the pressure on the water which begins to boil and produce steam. This process continues until it is necessary to recharge the tank with steam from the boilers.

The locomotive uses the well-established principle that the lower the air pressure the lower the temperature at which water will boil. The locomotive is rated at 35 tons with 20 x 18-in. cylinders and the storage tank is built for 200 lb. gage pressure. It will normally operate a day without recharging.

•

Charges REA Wastes Money and Material

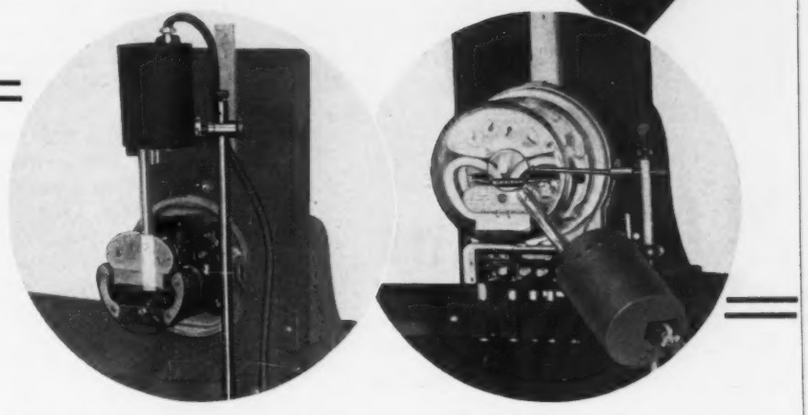
Under the pretense of Rural Electrification, enormous quantities of materials needed in defense and staggering sums of money are being wasted, Tom P. Walker, president of the Gulf States Utilities, stated recently in Dallas.

"The Brazos River Authority under political pressure turned down a proposition of utilities operating within transmission distance of Possum Kingdom Dam to buy power at $306,000 a year and deliver it to 29 REA cooperatives at 7.2 mills per kilowatt-hour," Mr. Walker said. "An offer of the tax-financed Brazos River Transmission Authority was accepted at $103,000 a year less than the private utilities offered. It served 50 percent fewer REA cooperatives and at a higher rate. It tied up the entire output for 25 years and requires 7½ million dollars of federal money to finance the cooperatives and provide for construction of 644 miles of line to duplicate transmission systems already in existence.

"Carrying out this REA program involves a waste of 1,750,000 lb. of copper, $1,555,000 of government funds and 300,000 man-hours of labor."

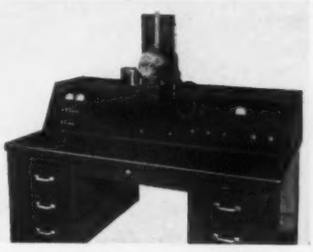
Mr. Walker called attention to the four plants generating power by fuel to safeguard water power and upon which engineering work has already been done. The cost of this develop-

Synchro-Meter Testing Lowers Cost



The Modulator or Synchronizer shown above projects a *modulated beam of light* upon the strobo marks (1) on the face, or (2) on the milled edge of the meter disc under test.

Meter Testing under a beam of light



You may well find that modernizing your present test table by adding the Synchronizer or purchasing a complete STATES Strobo Table for your laboratory will save you much more than its cost in a short time.

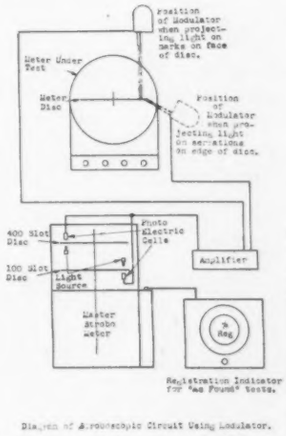

Position of Modulator when projecting light on marks on face of disc.
Meter Under Test
Meter Disc
Position of Modulator when projecting light on marks on edge of disc.
400 Slot Disc
100 Slot Disc
Photo Electric Cells
Amplifier
Light Source
Meter Strobo Meter
Reg.
Registration Indicator for "as Found" tests.

Diagram of Stroboscopic Circuit Using Modulator.

The tester makes any necessary adjustment while the meter disc is *in rotation*. He can determine instantly whether the meters are accurate and the effect made on the disc markings by the slightest twist of the meter adjusting screw.

Some of the reasons why utilities are using the STATES Synchronizer:

One Utility you know says:
"We are highly pleased with the results we are getting with the "Strobo" equipment. The operator says that he can test three times as many meters as previously."

Another Utility you know says:—
"Strobo Equipment has answered our problem of how to cut our test costs."

Another writes:—
"Our STATES Strobo Table has increased the output of meters tested by one man approximately 300% "

Testers like it because:—
It is easier—
It is faster—
It puts no strain on the operator—

To those who are responsible for meter testing, who are seeking ways to conserve time and work, to accomplish most in the shortest time—*it is timely* to look into synchro meter testing.

Full details will be gladly sent.

Kindly Tear Off and Mail today to

THE STATES COMPANY 3 New Park Ave. Hartford, Conn.

Please send me latest information on STATES Test Equipment for synchro-meter testing.

NAME ..... **TITLE** .....

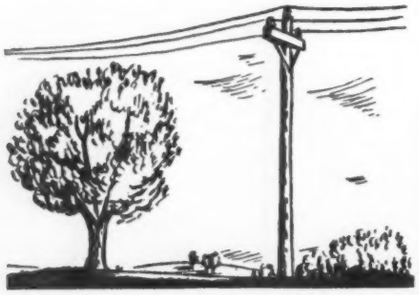
FIRM .....

CITY ..... **STATE** .....

Where every minute counts

At the "end" of every power line men are at work on jobs vital to our defense—work that must not be interrupted by power failures . . . A frequent but unnecessary cause of outage can be avoided now by putting it up to Asplundh to keep your lines free and clear of tree trouble . . . One of our several different contracts is sure to meet your requirements and budget.

Write for them today



ASPLUNDH
TREE EXPERT COMPANY

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Cambridge, Mass.	New Castle, Pa.
Alexandria, Va.	Pittsburgh, Pa.
Washington, D. C.	Omaha, Nebr.
Tulsa, Okla.	

ment, he said, will be about $6,000,000, and that this money alone to be wasted by REA would build over 9,000 miles of farm line and serve some 20,000 farmers or could be used for national defense.

"In July the OPM announced an aluminum plant for Arkansas requiring 125,000 kw. of power," Mr. Walker said. "Nearby electric companies in Arkansas, Louisiana, Missouri and Texas announced they were able to supply 65,000 kw. immediately and offered to install additional capacity to make up the balance required and sell it to the Aluminum Company at a rate of about 3.5 mills per kilowatt-hour.

"REA announced it would come to the aid of national defense by serving the plant, unfolding plans to construct about 2,000 miles of new transmission line and providing large generating plants, transformers and substations at a cost of $28,000,000, which would build 40,000 miles of farm line to serve about 80,000 farmers. The adjacent utilities could have provided the service by building less than 200 miles of new transmission lines and only one-half of the new generating capacity.

"The saving in copper alone of the utility company plans as opposed to REA is 16,130,000 lb., in galvanized steel stranded wire 4,000,000 lb. and in hardware 1,000,000 lb."

•

Another Chance Display Unit Takes to Road

A. B. Chance Co. has put another new demonstration and display unit on the road. Its purpose is to help men in the field get better acquainted with the methods and economy of live line maintenance.

Unit No. 5 carries enough hot line tools to handle a wide variety of maintenance jobs on voltages ranging from 6,900 to 220 kv. Also, for display purposes, it carries a complete line of hot tap clamps, samples of grounding equipment, samples of Chance guying fixtures, anchors, anchor rods and construction tools. This unit is under the supervision of Gene Thatcher, electrical engineer and hot line tool expert.

•

Stockholders Increase

General Electric stockholders on November 20, record date for paying the December 20 dividend, totaled 218,434, an increase of 5,594 over a year ago, W. W. Trench, secretary of the company, has announced.

Special pre-Christmas offer:

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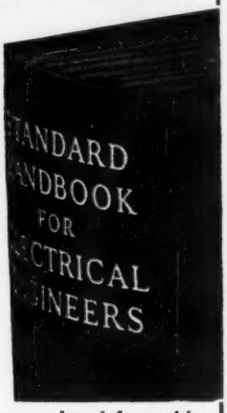

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Oswego Station Design Pioneers New Ideas

[*Continued from page* 81]

the boiler operator in the central control room the subsequent Diamond blowers follow automatically in predetermined sequence until the blowing is completed. An Autocall panel for this function is placed at the end of each boiler control panel. Air for house service at 100 psi. is taken from the same compressors.

Approximately half the ash melts and is drained from the furnace continuously into a pool of water which is emptied at intervals by means of the Allen-Sherman-Hoff system and delivered to the yard for fill to extend the coal storage pile area.

Prat-Daniel multi-cyclone dust catchers remove the fly-ash from the flue gases before they pass through the induced-draft fans en route to the 200-ft. all-welded Chicago Bridge & Iron stacks which are lined with 2 in. of gunite (a rich cement and sand mixture applied with an air gun).

Turbine Supervisory

Each General Electric turbine is 80,000 kw., single cylinder, 17-stage, 1,250 psi., 900 deg. F. with 13.8-kv. hydrogen-cooled generator and six extraction points. The 300-kw. direct-driven exciter is being used successfully as a starting motor for spinning and synchronizing the unit for synchronous condenser operation. There is also a 1-r.p.m. turning device provided.

Simplified protection for the turbine exhaust casing and the condenser shell against excess steam pressure has been provided without the use of a large and expensive atmospheric relief valve and the accompanying large relief piping to the roof. Should the pressure in the turbine exhaust start to rise, a pressure relay automatically trips the turbine stop valve and shuts off all steam to the turbine. Back-up protection is afforded by a diaphragm installed in the exhaust casing.

Detection of any mechanical irregularities in turbine behavior is facilitated by a supervisory panel which indicates and records eccentricity, vibration amplitude, expansion, speed and valve camshaft positions. An amplifier and loudspeaker permits the operator to build up any unusual sound so as better to diag-

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JOHN A. ROEBLING'S SONS COMPANY
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However, we are not using this situation as an excuse to do nothing. We are not callous to your problems and needs. We are doing everything humanly possible...with added men, added equipment, added hours ...to speed up production.
Sincerely yours,
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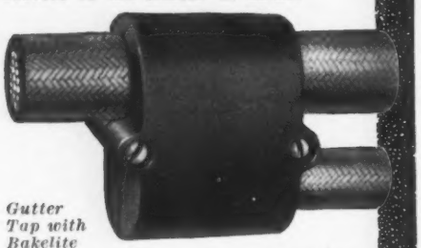
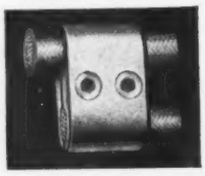
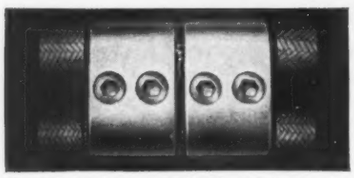
Now you can select from a really *complete* line of standard and special taps. Carefully designed—made right—and giving excellent service to all classes of users.



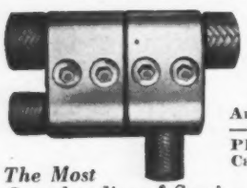
Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union Cable Taps.



2-Way Gutter Tap; main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.



Combination Cable Tap; one branch tap parallel to main, and one at 90°.

And many more—write for the PENN - UNION Catalog.

The Most Complete line of Service Connectors—Terminals—and thousands of other fittings, for all requirements.

Penn-Union is the choice of leading utilities, "industrials," and manufacturers of electrical equipment.

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Conductor Fittings

nose any premonition of trouble. This electrical testing rod (the loudspeaker) is of greatest value during starting.

Electrical Points

Flat construction for the 33- and 115-kv. switch structures gives protection against communicating fires. Use of large tubular bus conductors reduces the number of insulators required and makes for a clean-cut open structure.

Phase-to-ground current for a generator fault is limited by the impedance of the station service transformer.

There are four 50,000-kva. (fan cooled to 66,667 kva.) General Electric 13.2/115-kv. main generator transformers. The 33- and 115-kv. oil circuit breakers are Westinghouse and the air-break switches on the 575- and 2,300-volt auxiliary boards are I-T-E and General Electric. Auxiliary motors (General Electric) are started across the line up to 1,750 hp. Auxiliary 2,300/575-volt Pyranol-filled service transformers are located in the service bay of the station adjacent to the 2,300- and 575-volt metal-clad switchgear.

•

New Engineering Firm Organized in Chicago

Formation of Sines & Beckett, Inc., a new sales and engineering organization listing branch offices throughout this country and Canada, was announced recently. The new organization, with headquarters at 327 South LaSalle Street, Chicago, Ill., will act as exclusive international sales representatives for various manufacturers.

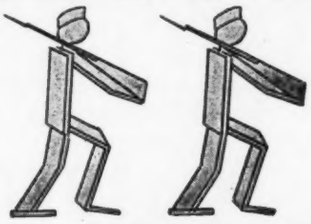
Both Harold Sines, president of the newly formed organization, and K. C. Beckett, vice-president and treasurer, have been associated with the electrical industry for many years in the utility and electrical manufacturing fields. Their activities will embrace the design, manufacture and sale of electrical and mechanical equipment.

•

Plans Plant Addition

Ranco, Inc., Columbus, Ohio, has approved plans for a one-story addition to plant, estimated to cost close to $50,000, with machinery. General erection contract has been let to Frank L. Matthaes, 427 East Dunedin Road, Columbus, and work will be placed under way at once.

GET IN STEP



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STRENGTH, ruggedness and durability are combined with definite economy in *Crapo* Galvanized Steel Strand. Low first cost, low maintenance expense are matters of record wherever this time-tested product is in use. Available in all standard grades and sizes from representative jobbers throughout the country. Or, write—

INDIANA STEEL & WIRE CO.
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Determine Transformer Load From Customer Records

[*Continued from page 74*]

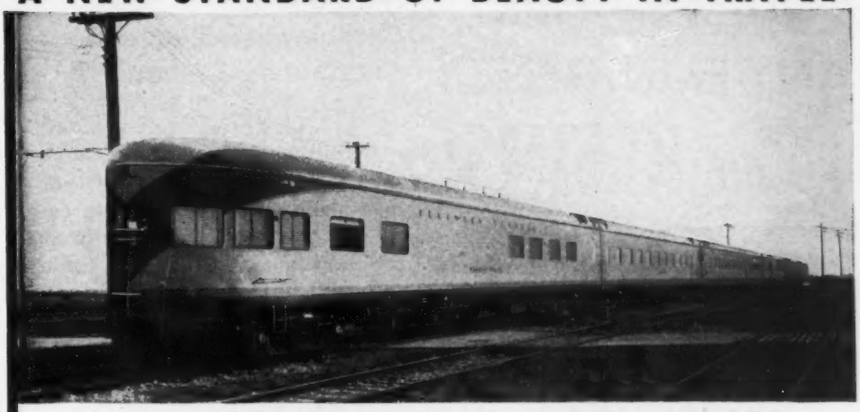
It will be noted that in the majority of cases the load actually measured by the ampere demand meter is less than that shown by the O. G. & E. method. This would be expected from the previous discussion of Figs. 1 and 2, which showed that the maximum daily load is above 90 percent of the annual peak only about 10 percent of the year. It is also to be expected that, in some cases, the annual peak will be greater than that shown by the O. G. & E. method because the latter is based on a diversified demand curve drawn to the average of points plotted from the original data. Differences between the annual peak and the calculated peak should be less than 10 percent in almost all cases, because the original data seldom depart from the average curve by more than this amount.

Two Specific Cases

The last two 10-kva. transformers shown in the table are notable. Both show the same peak by the O. G. & E. method, although the number of customers is quite different. Average consumption per customer shows that the 29 customers supplied by one transformer use more electricity and must have higher individual demands than the 39 customers supplied by the other transformer. Both are overlooked to the extent that relief is needed. The ampere demand meter method discloses the overload condition on only one transformer, on the other it shows a load of 11.5 kva., only 66 percent of the calculated peak and a load that would not be considered excessive for a 10-kva. transformer. Thus, only one of these transformers would have been replaced on the basis of the ampere demand meter method, although both transformers are overloaded to about the same extent.

The O. G. & E. method has been in routine use for only a few months and many refinements in method are yet to be worked out. But during this breaking-in period the load of 136 transformers has been determined in one division with an average of 2.6 man-hours per transformer, which compares quite favorably with other methods that have been used.

A NEW STANDARD OF BEAUTY IN TRAVEL

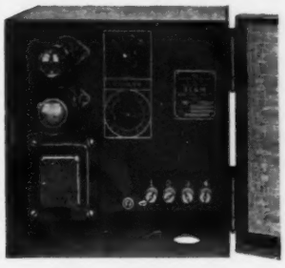


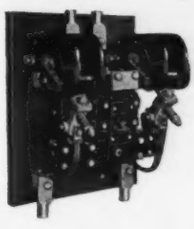
"City of Miami" built by Pullman-Standard Car Mfg. Co. for the Illinois Central R.R. Co. This train operates between Chicago and Miami in 29½ hours.

And the Construction

-AIDED BY *EC&M* WELD TIMERS

IS *Equally* OUTSTANDING!





PASSENGERS marvel at the exceptionally beautiful interior of this crack streamliner, "City of Miami." In achieving it, Pullman utilized craftsmanship of a high order.

A portion of the interior steel is joined by welding—using EC&M Weld Timers—thereby obtaining strong, *perfectly formed* joints without indentation and discoloration of the material being welded.

There's no guesswork with EC&M Weld Timers. Timing is *completely automatic.* Strong, uniform welds result. And, in addition, this accurate timing, by safely permitting higher welding current, saves welding time!

In welding stainless steels, galvanized metal, non-ferrous metals, sheet steel, etc., EC&M Weld Timers give outstanding results in both quality and quantity of work. Ask for descriptive Bulletin 1201, also for Booklet 141—a guide on welding procedure for operators.

● As companions for these Timers EC&M has a complete line of Heavy-duty, Fast-operating Welder Contactors to handle the main welding current. They are mechanically sturdy for this exacting service and very efficient. Ask for Bulletin 1211 describing them.

The Electric Controller & Mfg Co.
2700 E. 79th St. Cleveland, Ohio

E&M

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MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

EQUIPPED FOR ANY EMERGENCY with KLEINS!

"Since 1857"

WINTER'S a tough time for any line job, but when wires go down it's up to the lineman to restore service—in a hurry. The pliers, the strap that holds him safe, the tools in his belt and the very belt itself—all make his task easier—when they are Kleins.

Your copy of the Klein Pocket Tool Guide will be sent on request.

ASK YOUR SUPPLIER

Foreign Distributor:

International Standard Electric Corp., New York

Mathias KLEIN & Sons Chicago, Ill. U.S.A.

3200 Belmont Avenue, Chicago, Illinois

Range-Water Heater Combination Reduces Distribution Demand

[*Continued from page* 88]

Before every campaign we hold group employee meetings, getting as many as two hundred employees together at a meeting. Naturally these meetings must be made interesting and entertaining as well as educational, and that is the big problem. Remember, we have five of these each year for the same people, and we have been doing it for twelve years or more. Refreshments are always served in an effort to make a social evening out of it. In some cases we wind up with a dance and in others with paid entertainment. As a result, we get good crowds and our people give us their enthusiastic support.

Thin Territory

A brief description of the territory we serve may explain in part at least why we use some of the methods we do. We serve a territory that is about 500 miles long and 60 miles wide, with much of it sparsely populated. The largest city in the territory, of which we serve only about one-third, is about 40,000 population. In all we serve about 79 cities or villages, in which we maintain approximately 33 offices. Naturally most of these are quite small and the personnel is confined to a few employees.

Most of the customers we serve in this large territory are rural or in small communities and we do have a difficult merchandise problem as far as coverage is concerned with relation to expense. The total number of meters in the territory is about 36,000 and our residential meters about 25,000, less than one per square mile.

Much of our territory is also served in some manner with natural or butane gas through pipelines. In addition to gas competition, we also are faced with electric utility competition in two of our most thickly populated areas.

Ranges First

However, realizing early the necessity of actively building load and revenue in such a thinly populated territory in order to exist, we began as early as 1922 to develop the residential load, and particularly revenue, by the active promotion and sale of electric ranges. One salesman at that time was all the company had, and

EVERSTICK ANCHORS...

Provide dependable anchoring when poles are subjected to unusual strains from storms. Made of tough, certified, rust resistant, malleable iron for extra strength and holding power. Write for new bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Acme BIAS TAPES

For Extra Strength And a Good Slip!

These special-formula tapes have the good slip and stretch for a snug fit around difficult corners, and the tensile strength to stand a husky pull! Your men will like them because they are easy to use. You will like them because they are economical and do a safe, workmanlike job. Made of best cotton fabric coated with pure vegetable oil varnishes.

In tapes, straight or bias. Yellow or black. Tacky, greasy or dry. Samples on request.

THE ACME WIRE CO., NEW HAVEN, CT.

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VARNISHED INSULATIONS
MAGNET WIRE COILS

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★ SMITH COMPRESSORS are saving money for utility companies, utility construction companies, general contractors the country over. Consider the savings you'll enjoy with their use! BIG savings in purchase cost over standard compressors of equal capacity . . . important savings on upkeep, too! Made with FORD Motors and standard parts—that means dependability and economy. Repairs and parts at Ford garages everywhere. 60 cu. ft. size uses only one gal. of gasoline an hour! Handle all pneumatic tools used by construction companies. Easily portable—tow them from one job to another at permissible truck speeds. No couplings, belt, clutch or gears to wear and cause trouble. Head equipped with high speed compressor valves; automatic unloading and idling.

A utility company in Pittsburgh uses 31 Smith Compressors. Words of praise come from users everywhere. These are typical: "I am very well pleased with my compressor. I believe it is one of the best pieces of equipment I have ever bought." Signed, A. R. Welsch, Contractor, Joliet, Ill.

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AIR COMPRESSORS

most of the selling had of necessity to be done by the local employees, so we really got into the idea of employee cooperation early in the game from necessity. A little later two more salesmen were added to the force, and we really started merchandising, or so we thought at the time.

In The Early Days

Installation charges and first costs of ranges were something in those days, and the product at best was slow and unsightly and left much to be desired. Too, rates were higher then than now, and the cost of operation was such that only the chosen few could really afford to cook electrically. Terms were almost unheard of, and when it was necessary to resort to them they were made just as tough as possible. In other words, everything possible to make sales difficult was in evidence. Nevertheless, it is my recollection that a carload of ranges—about 60 in all—were disposed of, mainly to our employees, the first year.

From then on the department grew and expanded until we now have five full-time merchandise salesmen and thirteen part-time, together with a lighting sales engineer and a heating and air conditioning sales engineer.

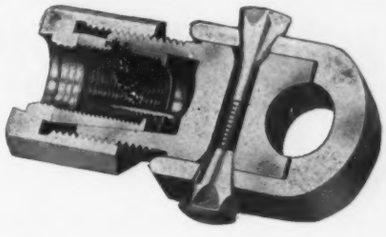
•

Research Will Produce Better Consumer Goods

Hardships imposed upon industry because of defense needs will result ultimately in the production of better consumer goods, according to F. L. Meacham, Frigidaire's manager of household engineering. Faced with lack of materials, industry has experimented with alternatives, many of which are proving more worthy and economical than materials used in the past, he said.

"Frigidaire has for many years," Mr. Meacham said, "used certain basic materials in production. And while our usual experimental research proved that other materials were entirely satisfactory, we did not use them simply because it was not necessary. Now, however, with many basic materials unavailable, we have been able to take advantage of our earlier research on certain other materials. . . . Many refrigerator parts formerly made of aluminum are now being made of porcelain-on-steel, and the porcelain-on-steel has proved so satisfactory, in some instances, that I doubt that we will ever go back to aluminum again. . . ."

Since time immemorial, the wedge has been the orthodox method of tightening and permanently joining two bodies together.



"Gorilla Grip" Mechanical Connectors use two types of this wedging principle to insure a mechanically as well as electrically perfect connection.

No special tools are required for any "Gorilla Grip" installation. The Connectors will not loosen after the connection is made and they may always be reclaimed for use again.

There is a "Gorilla Grip" Connector for every connection wherever it taps or terminates. Investigate, write for literature.

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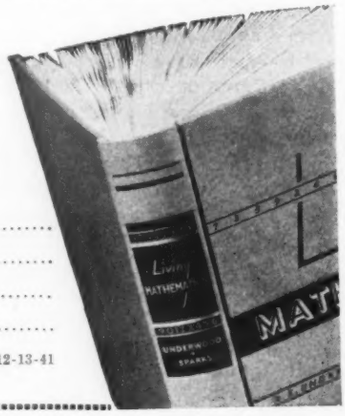

Sales Opportunities

WALNUT RIDGE, ARK.—Arkansas-Missouri Power Co., Blytheville, Ark., plans extensions and improvements in electrical distribution system at Walnut Ridge, including rebuilding of number of existing lines. Also will carry out similar work in distribution lines at Hoxie, Ark., with facilities for increased service.

GRAND COULEE, WASH.—Bureau of Reclamation, Denver, Colo., receives bids until January 5 for furnishing and installing three 108,000-kva., 13,800-volt, three-phase, 60-cycle, vertical shaft, a.c. electric generators for Grand Coulee power plant, Columbia Basin project, Wash. (Specifications 1018).

LOS ANGELES, CALIF.—Western Pipe & Steel Co., 5717 South Santa Fe Avenue, Vernon, Los Angeles, plans installation of heavy-duty motors and controls, switchgear, duct lines, transformers and accessories, interior and exterior lighting systems, conveyors, electric cranes, electric hoists and other equipment in new shipbuilding plant on West Basin, Los Angeles harbor, for construction of vessels for government. Company is arranging with Harbor Commission for lease of tract of about 34 acres for plant site. Power substation will be built for central station service. Entire project will cost about $3,500,0000. Work is scheduled to begin soon.

CINCINNATI, OHIO—Cincinnati Gas & Electric Co. has taken out permit for new indoor-type power substation at Central Avenue and Charles Street, estimated to cost about $30,000, exclusive of transformers, switchgear and auxiliary equipment. Superstructure will proceed at once.

MONTICELLO, ILL.—Illinois-Iowa Power Co., Monticello, has plans nearing completion for extensions in primary and secondary lines in parts of Clinton, Jefferson, Marion, Montgomery and other counties, for expansion in rural electric system, totaling close to 30 miles in all, with service facilities.

MUSKEGON, MICH.—Continental Motors Corp., 12801 East Jefferson Avenue, Detroit, Mich., manufacturer of gas and gasoline engines, plans installation of motors and controls, transformers and accessories, switchgear, duct lines, fluorescent lighting system, conveyors, electric hoists and other equipment in new plant at Muskegon for production of aircraft engines for government. Main unit will be one-story, about 320 x 680 ft. Cost reported over $1,500,000. Financing will be provided by Defense Plant Corporation, Washington, D. C., a federal agency.

OGDEN, UTAH—United States Engineer Office, 751 South Figueroa Street, Los Angeles, Calif., receives bids until December 23 for airport lighting system at Ogden, including 64 boundary light units, 18 range light units, 99 contact light units, wind velocity and direction transmitter unit, one code beacon, 58,140 lin. ft. of armored cable, 6,890 lineal ft. of rubber-insulated cable, 1,300 lin. ft. of fibre duct, etc., as per plans and specifications on file.

GLEN LYN, VA.—Appalachian Electric Power Co., Roanoke, Va., will double capacity of steam-electric generating station at Glen Lyn, in connection with new addition. Installation will include a new 80,000-kw. turbine-generator unit, high-pressure boiler and auxiliary equipment.

When It's

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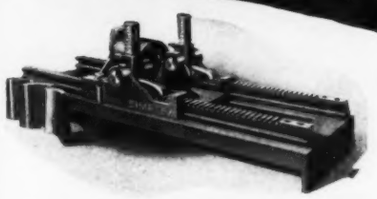

Simplex Double Leverage Pipe Pushing and Pulling Jacks eliminate much trenching, cut costs and improve public relations. Why dig up lawns, walks, streets and alleys when you can push tubes or ducts up to 100 ft. long for cable, necessitating only a small "starting trench?"

No buckling or binding. Positive push or pull. Jaws grip around pipe—no damage, no slippage. Pilot "breaks ground." Carriage is reversed for pulling pipe—rack need not be changed.

Today's urgency demands the speed and economy of Simplex Pipe Pushing and Pulling Jacks. For ducts ¾" to 4". Two models: R-332R, 15-tons capacity; R-334R, 25-tons capacity.

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Better, Safer Jacks Since 1899

Simplex Jacks
A better Jack for every job - many jobs for every Jack

CHICAGO, ILL.—United Drill & Tool Corp., 411 West Ontario Street, manufacturer of twist drills, dies and other cutting tools, plans installation of motors and controls, switchgear, duct lines, transformers and accessories, electric hoists, interior lighting system, conveyors and other equipment in new local plant for production of ordnance products for government. It will comprise several one-story units. Cost estimated about $1,942,000 and fund in that amount will be furnished by Defense Plant Corporation, Washington, D. C., a federal agency.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until January 6 for 1,600 knife switches for Portsmouth, N. H., Navy Yard (Schedule 9550); also, at same time for 37,000 sq. ft. of laminated phenolic switchboard material for Philadelphia, Pa. Navy Yard (Schedule 9638); for quantity of electric fuses for Eastern and Western navy yards (Schedule 9601).

GRAND ISLAND, NEB.—Central Nebraska Public Power & Irrigation District, Hastings, Neb., plans new transmission line from Johnson Canyon hydroelectric generating station to Grand Island. Application has been made for permission. Proposed to begin work soon.

LUFKIN, TEX.—Southland Paper Mills, Inc., Lufkin, plans installation of motors and controls, regulators, duct lines, switchgear, industrial lighting system, conveyors and other equipment in new addition to newsprint mill, to increase plant capacity from 50,000 to 100,000 tons per annum. Expansion will include pulp and paper-making divisions, and auxiliary departments. Cost reported over $2,000,000. Company has received priority rating for necessary materials and proposes to begin work soon. It is understood that George F. Hardy, 305 Broadway, New York, N. Y., consulting engineer, will prepare plans for project. E. L. Kurth is president.

SAN ANTONIO, TEX.—Quartermaster, Normoyle Quartermaster Depot, San Antonio, receives bids until December 29 for one motor-driven air compressor, capacity of 900 cu. ft. per minute, with necessary accessory units (Proposal 632-31).

WAVERLY, IOWA—Municipal Light Department plans expansion and improvements in municipal power plant, including installation of new generator unit and accessories. Cost estimated about $90,000.

•

Annual Electric Bill $25

The average American family spent $25—1.8 percent of its income—in 1935 and 1936 for electric service, according to a National Resources Planning Board report showing what American families did with their money in those years. The report is a 200-page document based on a sampling of 60,000 families of all income levels. It is available from the Superintendent of Documents, Washington, under the title "Family Expenditures in the United States," for 50 cents.

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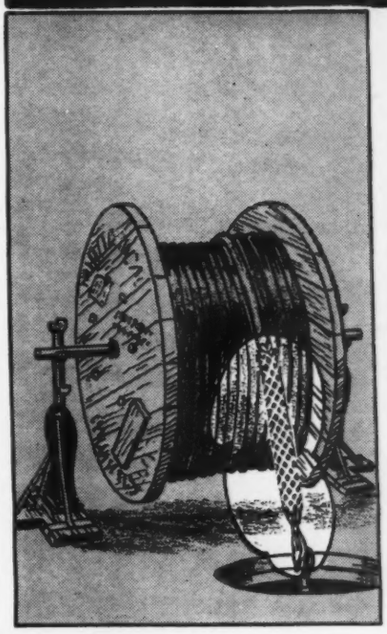

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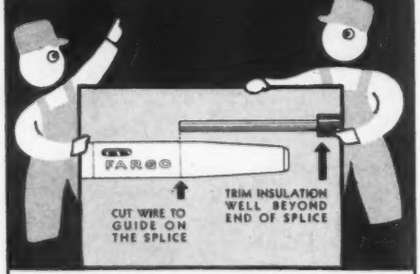

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Recent Rate Changes

COAST COUNTIES GAS & ELECTRIC CO.'s electric and natural gas rates will be reduced $280,000 annually, Commissioner Richard Sachse of the California Railroad Commission has announced. The reduction, which follows the conclusion of an investigation of the company's operations during the past year by the staff of the commission, means electric rates will be lowered $88,000 on an annual basis and natural gas charges $192,000. The new rates will be placed in effect as soon as engineers of the commission and representatives of the company work out the new rate schedules. The utility operates in Contra Costa, Merced, Santa Clara, San Benito, Kern, Santa Cruz and Monterey counties. "The commission is gratified at the successful conclusion of this matter within the scope of the commission's policy of continuous investigation and avoiding the necessity of a lengthy formal proceeding," said Commissioner Sachse. "We are pleased with the co-operative attitude displayed by the Coast Counties Gas & Electric Co. The reduction will mean an immediate and substantial saving to the utility's electric and natural gas customers as this is the largest single reduction ever made in the rates of this company."

UNITED ILLUMINATING CO., New Haven, has announced a second reduction—on one month's bills to consumers. The plan has been approved by the Connecticut Public Utilities Commission and a reduction of 25 percent will be made on all December bills. A reduction of 40 percent was made on May bills. The saving to customers for the year will aggregate $648,000, including $280,000 estimated savings in December.

LAS VEGAS LIGHT & POWER CO. has reached an agreement with the New Mexico Public Service Commission that will save Las Vegas electricity users approximately $14,000 a year. Commission Chairman G. S. Carter said the rate reduction would go into effect February 1, although it was still "subject to consideration." Any revision of the present agreement, however, will be merely to increase the rate cut, Chairman Carter stated. Under the agreement the municipalities of Las Vegas and Old Las Vegas will save about $2,000 a year. The city councils of these cities have met and approved the rates negotiated between the company, the mayors and the commission.

CITY OF PLATTSBURG, N. Y., has been permitted by the state Public Service Commission to put into effect revised schedules for residential and commercial service which will result in an annual reduction of more than $33,000 to customers of its electric plant. About $18,000 of this amount will be scaled from rates to residential customers and the balance will accrue to the benefit of commercial customers. The new rates became effective December 1. In the revised residential classification the minimum charge of $1.00 a month is retained but the amount of energy included in the initial charge is increased from 12 to 15 kw.-hr. In the commercial classification the city will eliminate demand as an element in the rate. Under the old schedule customers paid $1.50 per kilowatt of demand for use over one kilowatt. The initial energy charge will be $1.00 per month and will include 15 kw.-hr., as against 12 kw.-hr. under the old schedule.

VILLAGE OF WATKINS GLEN, N. Y., which operates a municipal electric plant, has been authorized by the state Public Service

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with and without protective housing. Cemented with heat, oil, acid and solvent resisting cement. 6 sizes—from 220 up to 1000 Watt.

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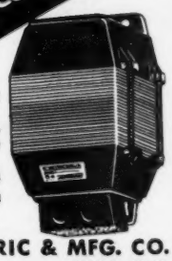

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Here are just three of the complete line of Greenlee Benders for any size conduit, pipe, or tubing from ¼ to 4½ inches. Small hand benders will handle all tubing up to ¾-inch, while powerful hydraulic benders will take care of conduit and pipe up to 4½ inches. Write for S-116 Bender Booklet describing complete line of benders and attachments.

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1705 Columbia Avenue
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Commission to put into effect new rate schedules which will result in savings of approximately $3,500 annually to users of electricity. The village plant, in addition to serving customers in Watkins Glen, also serves customers in the towns of Reading and Dix. The new rates became effective December 1. The revision establishes a new residential classification with a minimum charge of 90 cents per month, the minimum charge including 15 kw.-hr. of energy. The saving in the residential classification will range from 18 cents to $1.18 per month. Lesser reductions are provided in the commercial classification.

•

REA Construction Contracts Awarded

Among REA construction contracts recently approved were the following:

ARKANSAS—Carroll Electric Cooperative Corp., Berryville, Paul F. Arnold, supt., and Midwestern Engineering and Construction Co., 307 Drew Bldg., Tulsa, Okla., engineer, contract to Killoren Electric Co., 116 S. Superiod St., Appleton, Wis., 200.86 miles of line, 614 members; bid, $177,577.

GEORGIA—Colquitt County Rural Electric Co., Moultrie, J. H. Halpert, supt., and E. P. McLean Engineering Co., 222 Commercial Bldg., Moultrie, Ga., engineer, contract to Roy Richards, Carrollton, Ga., 9.5 miles of line; bid, $65,252. Carroll Electric Membership Corp., Carrollton, W. G. Foster, supt., and J. B. McCrary Engineering Corp., 1408-22 Marietta Street Bldg., Atlanta, Ga., engineer, contract to Roy Richards, Carrollton, Ga., 180.9 miles of line, 470 members; bid, $132,191. Central Georgia Electric Membership Corp., Jackson, Robert Armstrong, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Alrich Electric Construction Co., 718 Reynolds St., Augusta, Ga., 223 miles of line, 469 members; bid, $143,440.

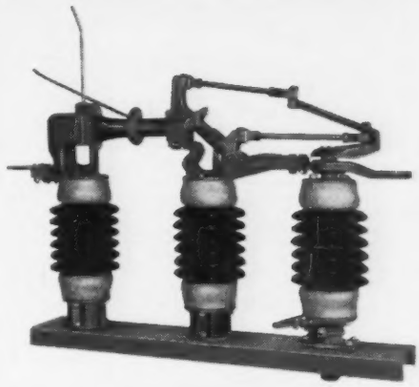
ILLINOIS—Adams Electrical Cooperative, Camp Point, Dean Searle, supt., and George D. Simpson & Co., 808 Ferguson Bldg., Springfield, Ill., engineer, contract to C. A. Hooper Co., Madison, Wis., 215.3 miles of line, 372 members; bid, $157,604. Corn Belt Electric Cooperative, Inc., Bloomington, T. H. Hafer, supt., and George D. Simpson and Co., Springfield, Ill., engineer, contract to Contracting and Material Co., 1235 Dodge Ave., Evanston, Ill., 136.7 miles of line, 260 members; bid, $98,050. Tri-County Electric Cooperative, Inc., Mt. Vernon, B. H. Tuttle, supt., and Michael Drazen and Associates, 4903 Delmar Blvd., St. Louis, Mo., engineer, contract to Contracting and Material Co., 1235 Dodge Ave., Evanston, Ill., 274 miles of line, 511 members; bid, $204,724.

IOWA—Pocahontas County Rural Electric Cooperative, Pocahontas, George H. Stockdale, supt., and K. R. Brown, 803 Valley Bank Bldg., Des Moines, Iowa, engineer, contract to Lippert Bros. Construction Co., Boone, Iowa, 95 miles of line, 184 members; bid, $65,258. Pella Cooperative Electric Assn., Pella, K. R. Brown, 803 Valley Bank Bldg., Des Moines, Iowa, engineer, contract to Evans Construction Co., Early, Iowa, 67.3 miles of line, 118 members; bid, $47,421.

MISSOURI—Farmers' Electric Cooperative, Chillicothe, Ernest Wood, supt., and Frank Horton and Co., Lamar, Mo., engineer, contract to Dutton Electrical Co., Inc., 8532A West Schlinger Ave., West Allis, Wis., 75 miles of line, 138 members; bid, $54,523.

NEBRASKA—Cuming County Rural Pub-

SOUTHERN STATES' SHORT-CUT *alog* NO. 2



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Available in 400, 600 and 1200 amperes from 7.5 kv. through 34.5 kv., 600 amperes from 46 kv. through 161 kv. Higher amperage and voltage ratings may be furnished. Mounting is vertical, upright or underhung, in accordance with your requirements.

CONTACTS: Full-floating, self-aligning, constant pressure type shunted with flexible tinned copper braid. Contact shoes are backed by coil-type phosphor bronze springs.

BLADE MOVEMENT: In closing, the blade moves from open position to a position parallel with the base. In the final movement, the blade travels longitudinally parallel with the base and "snoots" into the jaw contacts. When the switch opens, these movements are reversed.

BLADE LINKAGE: Positive ice-breaking leverages speak for themselves in this close-up of the linkage. You can tell from the formation of the ice that the blade was opened *after* the ice had formed.

METAL PARTS: All current carrying parts are bronze and high copper-content alloy with silicon bronze bolts, nuts and washers. The blade is seamless copper tubing. All other metal parts are hot-dip galvanized structural steel and malleable iron.

NEMA and AIEE specifications are met with ample safety factor throughout in the design and construction of Southern States' Type JC Disconnecting Switches.

Ask your Southern States' representative for further information, or write for Bulletin 325 which contains complete information concerning Southern States' Type JC Disconnecting Switches.

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HARD PORCELAIN
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Lamp Replacers
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We have been making safety tools for 26 years
THE G. C. A.
Manufacturing Co.
Pittsfield, Mass.

NEW SWITCHBOARD
INDICATING LAMP
FOR SINGLE HOLE PANEL MOUNTING
Type T2 Unit

The threaded shell is molded in the same color as the lens-cap to prevent error in replacement . . . furnished with a G.E. 24 volt slide-base lamp, (0.038 amp.) . . . overall diameter ¾" . . . used with a series resistor assembly for operation on voltages up to 440 . . . six different colors . . . Red, Green, Blue, Amber, White and Clear . . . brilliant 180 degree visibility . . . low in cost.
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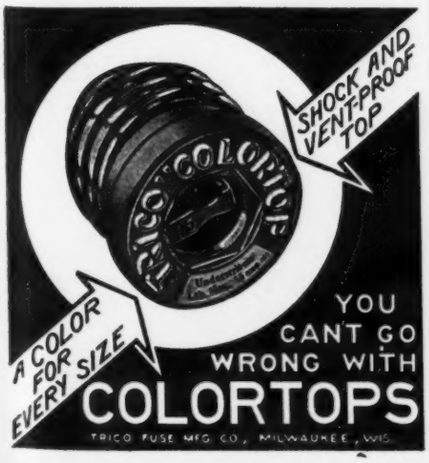
GRAYBAR ELECTRIC CO.
H. R. KIRKLAND CO., Morristown, N. J.



lic Power District, West Point, Lester C. Sellentin, supt., and H. H. Henningson, 625 Standard Oil Bldg., Omaha, Neb., engineer, contract to Vasak Construction Co., Crete, Neb., 23.85 miles of line, 47 members; bid, $17,791.

OREGON—Lane County Electric Cooperative, Inc., Eugene, Ronald Wayne Buford, supt., and John W. Cunningham and Associates, 1112 Spalding Bldg., Portland, Ore., engineer, contract to Max J. Kuney Co., 418 Hutton Bldg., Spokane, Wash., 375.3 miles of line, 1,475 members; bid, $436,482.

PENNSYLVANIA—Claverack Electric Cooperative, Inc., Towanda, Clarence E. Jakway, mgr., and Gibbs and Hill, Inc., 600 N. Second St., Harrisburg, Pa., engineer, contract to Miller-Baxter Co., Inc., 445 N. Pennsylvania St., Indianapolis, Ind., 228 miles of line, 715 members; bid, $186,652.

SOUTH CAROLINA—York County Electric Cooperative, Inc., York, J. B. McCrary Engineering Corp., 1408-22 Marietta Street Bldg., Atlanta, Ga., engineer, contract to Little Electric Co., Union, S. C., 186.1 miles of line, 529 members; bid, $127,554.

TEXAS—Floyd County Rural Electric Cooperative, Inc., Floydada, L. W. Chapman, supt., and H. N. Roberts, 2415 20th St., Lubbock, Texas, engineer, contract to Reinhart and Donovan Co., 804 Commerce Exchange Bldg., Oklahoma City, Okla., 231.2 miles of line, 384 members; bid, $119,420. Cap Rock Electric Cooperative, Inc., Big Spring, Orval B. Bryan, supt., and Price and Hawk, P. O. Box 1238, Lubbock, Texas, engineer, contract to McClure Electric Co., 808 Good St., Dallas, Texas, 168 miles of line, 383 members; bid, $91,844. New Era Electric Cooperative, Inc., Athens, Beavers and Lodal, 1411 Smith Young Tower, San Antonio, Texas, engineer, contract to Reinhart and Donovan Co., 804 Commerce Exchange Bldg., Oklahoma City, Okla., 310 miles of line, 571 members; bid, $191,427.

UTAH—Beaver Valley Electric Assn., Beaver City, Rocky Mountain Engineering Co., 1554 California St., Denver, Colo., engineer, contract to Beaver City Corp., Beaver City, Utah, 12.5 miles of line, 37 members; bid, $8,647.

WISCONSIN—Waupaca Electric Cooperative, Iola, Hugh C. Patterson, supt., and Wisconsin Development Authority, 602 Tenney Bldg., Madison, Wis., engineer, contract to C. A. Hooper, Madison, Wis., 54.50 miles of line, 129 members; bid, $40,659. Bayfield Electric Cooperative, Inc., Iron River, Arvid Wentela, supt., and Wisconsin Development Authority, Madison, Wis., engineer, contract to Hallett Construction Co., Crosby, Minn., 246.40 miles of line, 465 members; bid, $161,995.

Citizens Must Approve Power Lines Concession

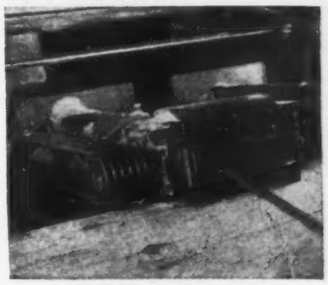
City of Centralia, Wash., must secure approval of its voters on a plan to grant Puget Sound Power & Light Co. the right to run power lines through the city on a lease basis, according to a decision of Attorney-General Smith Troy at Olympia. The Council had asked if it could give the company a franchise without referring it to the electorate. The company's franchise with the city expired last March. The company serves no Centralia customers, since the city owns its own system.

Pioneered
THE DESIGN OF A MACHINE TO REMOVE
Sapwood . . .

THE FIRST PROCESS TO INSURE ADDED ABOVE THE GROUND SERVICE LIFE IN CEDAR . . . . .

DURAPOLE
the first cedar pole to give users the many benefits of machine shaving and full length treatment in heated A.W.P.A. Grade #1 creosote.

It is the thick areas of sapwood that become infected and cause pole decay. By developing the pole shaving machine, Valentine Clark now can machine shave the sapwood over the entire pole above the ground line so that not more than ½ inch of sapwood remains. Then, when the cedar poles are completely immersed in heated creosote; the surface of the remaining sapwood, and all bolt holes and checks are thoroughly treated.



The shaving machine

It pays to specify
DURAPOLE

Valentine Clark has always given the highest quality—built the first butt treating unit in 1907—pioneered cushion machine incision—first with the concave gain—first with the slab gain—first to offer "The Finished Cedar Pole".

VALENTINE CLARK CORPORATION
2516 DOSWELL AVE., ST. PAUL, MINN.
Dwight Building, Kansas City, Mo.
84 William St., New York City

LETTER TO THE EDITOR

Get Something Done About It

To the Editor of ELECTRICAL WORLD:

The article on off-peak power in the November 15 number of ELECTRICAL WORLD makes sense.

The problem is to get something done about it. Availabilities and locations of all sizable blocks of such power should be studied and recorded to facilitate the locations of defense industries. The need for a clearing house, a go-between or liaison office, is indicated. Perhaps the Federal Power Commission could undertake this function.

Having taken the initial step of publishing an article drawing attention to off-peak power availability, ELECTRICAL WORLD should not let the idea die.

V. H. MOON,
Central Service Corporation,
Chicago, Ill.

•

Philco Announces Two New Service Programs

Two new service programs—for refrigeration and air conditioning equipment—were recently announced by Philco Corp. First step in putting the service programs into operation will be the selection of service men or service organizations having the equipment and experience necessary to qualify as authorized Philco service stations. It is anticipated that the servicing of all Philco refrigerators and air conditioning equipment in the country will be done eventually by this group.

Authorized Philco service stations in both the refrigeration and air conditioning fields will receive without cost a steady flow of service bulletins from the home office describing details of installation, operation and other technical information essential to general service. Meetings will be conducted for members by the Philco field service engineers to introduce new models and to explain design, engineering, operation and servicing.

•

Awards Battery Contract

Air Corps, United States Army, Washington, D. C., has awarded a contract to the Electric Storage Battery Co., Philadelphia, for storage batteries for aircraft service, at $102,836.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

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Positions Wanted (full or part time salaried employment only) ½ the above rates payable in advance.
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An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

POSITIONS VACANT

ELECTRIC MOTOR TESTER, experienced on AC and DC motors and generators. Give full particulars, age, nationality, education, previous experience and salary desired. P-982, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL DRAFTSMEN — one or more years experience with electric utility, engineering service corporation or consulting engineers in drafting and layout of substations. Graduation from recognized technical school and/or electrical operating experience highly desirable but not essential. Reply stating experience, qualifications, personal history, salary expected, etc. P-988, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEERS: Excellent opportunity for recent graduates in electrical engineering to assist in technical studies and design work, with good opportunity for development into more responsible positions. Large engineering and consulting organization in New York City. Give full particulars, age, education, previous experience if any, and salary expected. P-989, Electrical World, 330 W. 42nd St., New York, N. Y.

DRAFTSMEN: Electrical designers preferably experienced power plant and substation. In reply give age, experience and salary expected. P-990, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 32 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R.W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN, Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

ELECTRICAL ENGINEER, fifty, unmarried, now employed in congenial traveling position; but wishes to change to employment permitting establishment of a home. Thorough training and knowledge of electrical machinery maintenance and operation. Wide experience utility engineering. Recent experience plant electrical engineering layouts. Well read, vigorous, long life expectancy, and able to get along in difficult situations and direct others. History—1912-1917 operation and maintenance of electrical machinery, 1917-1919 U. S. Army, 1919-1920 City Engineering, 1920-1931 from chief draftsman to electrical engineer to first assistant to Engineer, midwest utility, 1931-1934 sickness, 1934-1941 from stationary engineer to maintenance electrician to electrical engineer. Experience spotted; but each time able to learn new professional duties and advance. PW-970, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

BE A METER EXPERT
YOU CAN EARN MORE
THOROUGH TRAINING by mail under personal instruction of practical engineers.
EARN $2,000 to $4,000 per year.
25 years' experience with Successful Graduates everywhere. LOW COST—EASY TERMS.
Free Booklet Without Obligation. Write Now!
Ft. Wayne Correspondence School, Dept. 12-A
Ft. Wayne, Ind.

POSITIONS WANTED

POSITION WANTED: 45 years old, 2 years University, now employed, desires change. 25 years as draftsman, construction, maintenance and chief electrician for Industrial Plant and Public Utility, General Manager Testing Laboratory, Salesman and Field Representative for Electric Manufacturer. Good personality. Successful as handler of men, and holder of customer good will. Excellent references. Would consider permanent position with prospects of advancement. PW-987, Electrical World, 330 W. 42nd St., New York, N. Y.

FREE BULLETIN

NEW CATALOG on Rebuilt Power Equipment, 32 pages, 4"x9", classified, indexed and illustrated. Write to Chicago Electric Co., 1320 W. 22nd St., Chicago, Ill.

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